CONTENTS

FOR ENGINEERS AND CONTRACTORS CONTROLLING THE DESIGN, SPECIFICATION, INSTALLATION AND MAINTENANCE OF HEATING, VENTILATING AND AIR CONDITIONING.

HEATING & VENTILATING
AIR CONDITIONING

FOR DECEMBER, 1939

Air Conditioning Cuts Heating Cost 50%	13
The Weak Spot in the Contractor's Business	16
Profits in Air — Maxwell House Coffee	18
Profits in Air — The Haughton Elevator Company	23
Profits in Air — Woodward Iron Company	27
Selecting Design Temperatures for Heating	30
Air Conditioning Available in 1940 Automobile	32
Commercial Stokers for Anthracite	33
How to Reduce Sun Heat through Windows	35
Electric Heat for the Bathroom Floor	41
Editorials	42
Abstracts	43
Brief Reviews	44
News of the Month	45
Reference Data, 163 and 164	50
With the Manufacturers	51
New Equipment	52
Degree-Days for October, 1939	58
Summer Degree-Hours for October, 1939	60
Coming Events	62
Photographic Credit Box	62
New Trade Literature	63

IN YOUR NEXT ISSUE:

In January two shows of equipment will usher in the new year. The one in Chicago specializes in cooling and refrigeration equipment with its air conditioning application; the one in Cleveland specializes in heating, ventilating and air conditioning equipment. Our coming January issue will contain a section telling about these two shows. You won't want to miss this feature.

Then, too, this same issue will contain our Seventh Annual Yearbook of Progress — a tabular, graphic and descriptive treatment of what took place in 1939. It will contain sections on Winter Heating and Conditioning, Summer Cooling, Year-Round Functions, and Controls and Instruments; each section also contains a description of the new equipment announced this year.

A nationally-known economist will present a forecast of building construction for 1940. A special added feature is a continuation of the series of industrial installation articles showing how intelligent manufacturers are making profits in air.

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VOLUME 36 NUMBER 12

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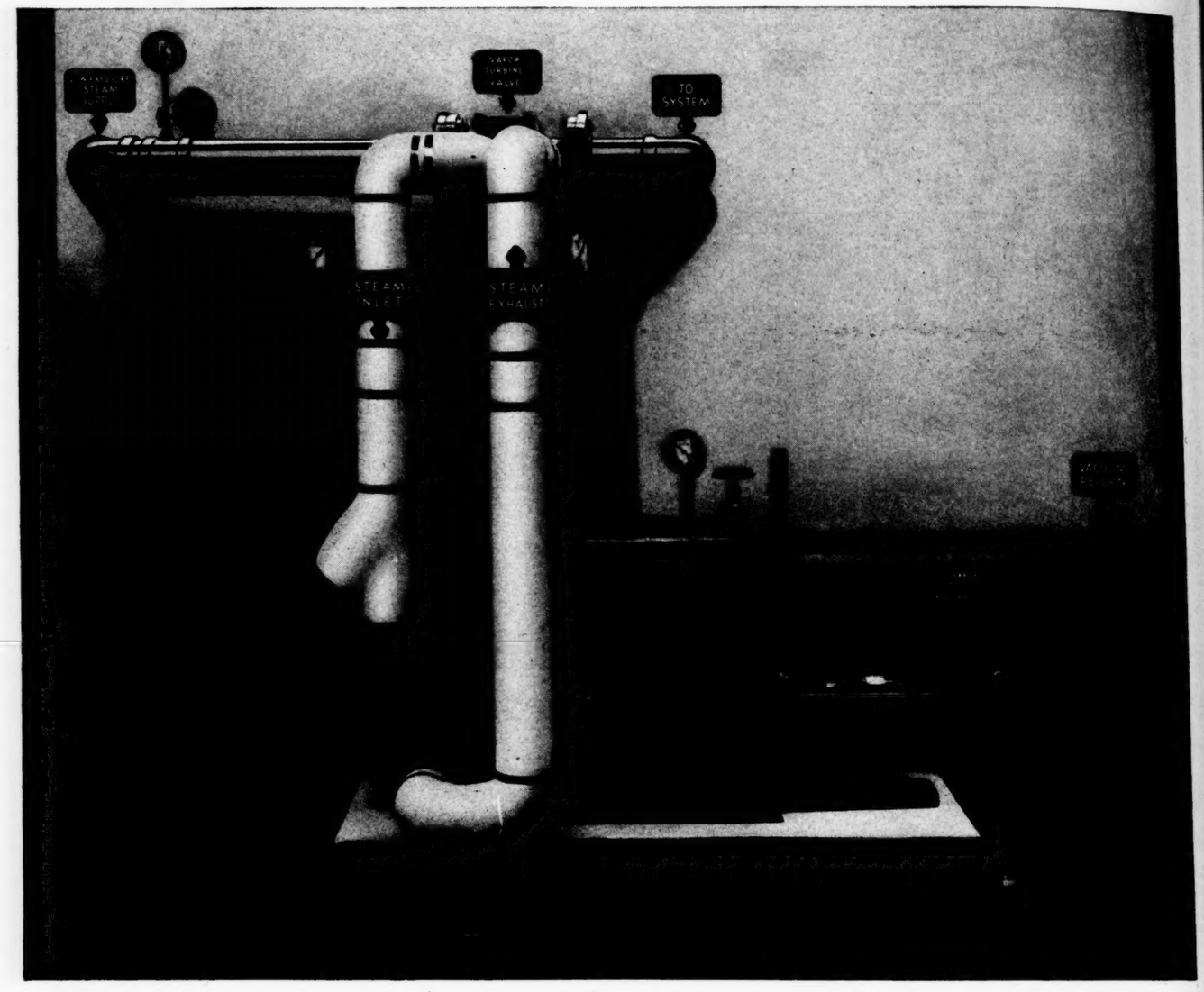
Where Heat Must Not Fail— Install this SAFE Heating Pump!



In Hospitals, Greenhouses, Schools, Public Buildings, Theatres, wherever heating systems must not fail, install the Nash Vapor Turbine, for it is independent of electric current failure, and continues to operate as long as there is steam in the system.

This is because the prime motive power of this economical pump is a special steam turbine, controlled by a unique "Vapor Turbine Valve", which automatically bypasses from the heating main a small portion of steam, the exact amount necessary to develop the power needed to remove the condensate and maintain the required vacuum on the system. Even this small amount is passed immediately back to the mains, and goes on to the system with little heat loss. This pump operates on any system, high or low pressure.

The Vapor Turbine is a most economical pump, for the elimination of electric current does away with current cost, the largest single item in the operation of an ordinary return line heating pump. Bulletin on request.

THE NASH ENGINEERING COMPANY

205-A S. WILSON ROAD, SOUTH NORWALK, CONNECTICUT, U. S. A.

In this San Antonio utility building air conditioning not only gave improved year-round comfort but also cut the cost of heating in half. Other outstanding features of the system are a central refrigeration plant with separate air conditioning units serving each floor, 144 controls for accurately controlling indoor conditions and a central time clock for starting the refrigerating and air conditioning units step by step at ten second intervals.

Air Conditioning Cuts Heating Cost 50%

By A. J. RUMMEL†

PRIOR to the installation in 1936 of the complete air conditioning system in the six story office building of the San Antonio Public Service Company, San Antonio, Texas, the building was heated by means of a gas fired steam heating boiler which furnished steam to 13,103 sq. ft. of steam radiator surface throughout the building. The building is of reinforced concrete construction with two inch metal lath and plaster partitions forming the individual office spaces. When the complete system was installed, all individual radiators in the building were removed and provisions made to heat the building with warmed air distributed to the various office spaces through the same duct system used to distribute cooled air in the summer.

An analysis of the records of the fuel consumption before and after the system was installed shows that in addition to more satisfactory indoor conditions being maintained during the winter months the annual fuel consumption was reduced more than 50 per cent. These records show that during 1935 and 1936 there was used for heating purposes 2630 cu. ft. and 2610 cu. ft. respectively of 1000 B.t.u. natural gas per degree day. Since the installation was completed, the records show a gas consumption of approximately 1200 cu. ft. per degree day, or less than one-half the amount previously used.

This reduction in fuel consumption is the result of a complete system of automatic controls constantly maintaining the desired indoor conditions in all parts of the building as needed, as compared to the radiator system in which each radiator was manually controlled —with the result that a good part of the time heat was supplied certain areas when not needed and numerous windows throughout the building were opened with the radiators on full.

Before the system was installed a careful analysis of the human occupancy, lighting, and exposure loads indicated that a heating and cooling system capable of a wide range in flexibility together with coordinated zoning would be necessary to meet all the requirements. For instance, the second and third floors of the building are occupied by the bookkeeping and auditing departments of the company. On each of these floors there are 52 employees and a lighting load of 35,000 watts. The load is so divided that on the south side of each of these floors there are approximately 40 employees working and a lighting load of 28,000 watts as compared to the 7000 watts and 12 employees on the north side. This uneven distribution of load often makes it necessary in the spring and fall months to cool the south side when heating is required on the north side.

Another problem in proper control was presented by the Home Service Division of the Commercial Department, located in the basement of the building. The auditorium of this department is used for the holding of cooking classes regularly each week. During these classes there is an occupancy of between 100 and 150 people for several hours, at other times there are only four or five employees in the department.

The first floor of the building is used as a general office and appliance display floor, while the fourth, fifth, and sixth floors are divided into a number of small individual offices.

120 Tons of Refrigeration

The complete system for conditioning the air for the six main floors consists essentially, as shown in Fig. 4, of one gas fired steam heating boiler, three electric motor driven 40 ton F 12 reciprocating compressors with by-pass valves allowing for a 50 per cent reduction in capacity, and a shell and tube water cooler, all located in the basement; individual spray type cooling, dehumidifying, and humidifying units, located on each floor; and two evaporative condensers located on the roof of the building.

For conditioning the air for the Home Service Division in the basement there is a separate system in-

†Air Conditioning Engineer, San Antonio Public Service Co.

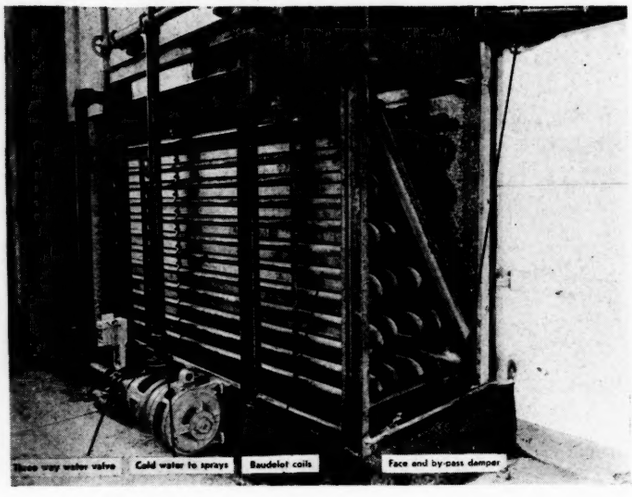


Fig. 2. Air conditioning unit which serves one floor. Outer casing has been removed to show construction. The spray chamber and fan are mounted directly above the coil chamber.

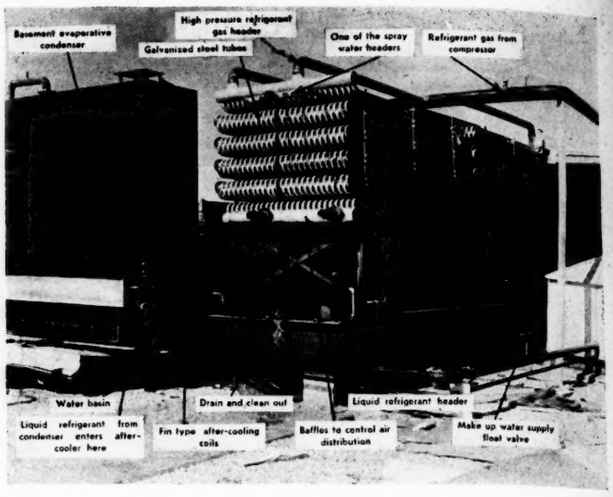

Basement evaporative condenser
High pressure refrigerant gas header
Galvanized steel tubes
One of the spray water headers
Refrigerant gas from compressor
Water basin
Drain and clean out
Liquid refrigerant header
Liquid refrigerant from condenser enters after-cooler here
Fin type after-cooling coils
Baffles to control air distribution
Make up water supply float valve

Fig. 3. Three evaporative condensers on roof which condense hot refrigerant gas from basement compressors. Two units in front have outer casing removed to show construction.

stalled, also shown in Fig. 4, which operates independently of the rest of the building. This system consists of a 20 ton electric motor driven F 12 reciprocating compressor and a spray type dehumidifier with internally mounted direct expansion serpentine flooded coils, all located in the basement; and a separate evaporative condenser, located on the roof.

Operation of System

During summer operation, chilled water is supplied the baudelot coils in each floor dehumidifier and cooler from the water cooler in the basement in which the water is cooled from 45F to 41F. Fig. 2 shows one of the individual floor units while under construction with the outer casing removed. The spray chamber and fan are mounted directly above the coil chamber. As will be noted from Fig. 2, during the summer operation the chilled water after passing through the sprays passes over the baudelot coils where it is cooled to the desired temperature before going to the lower tank from where it is again delivered to the sprays. The three-way water valve shown in Fig. 2 is operated, during summer operation, by a thermostat located on the discharge side of the spray. When the air temperature leaving the spray is above the thermostat setting, it closes the suction side of the pump from the upper tank, which contains the water after it has passed through the spray, and opens the suction of the lower tank, which contains the water after having passed over the baudelot coils and cooled. This operation is reversed when the air temperature leaving the spray is below the thermostat setting. In front of the fan, mounted on the side of each of these units, is located a heating coil which is supplied with steam in the winter from the boiler in the basement. The spray unit is used to humidify the air during the heating season.

Fig. 3 shows the three evaporative condensers located on the roof. The two which have the galvanized iron housing removed are used in connection with the three 40 ton compressors and are connected in parallel. The tubes of these condensers are made of steel which are welded into headers and which were annealed after construction and then heavily galvanized. After the refrigerant liquid leaves the condenser tubes it passes through a finned tube after-cooler where it is further cooled. The third condenser shown is used in connection with the 20 ton basement compressor.

Separate Controls for Each Office

The air distribution system for the six floors was originally installed with three separate zones on each floor—the air supply to each zone being controlled by means of a motor operated zone damper actuated by a thermostat located in each zone. In addition, thermostats were installed in each individual office which actuated a damper in each branch duct.

The accuracy with which indoor conditions can be regulated and maintained is apparent upon an inspection of the control system. A total of 144 controls are used. On each of the six floors near the return air grilles there are located small panel boards on which are mounted the controls for maintaining the proper floor temperatures throughout the year. On each of these panel boards are mounted the following controls:

(1) A sensitive thermostat which during summer operation controls the face and by-pass damper operation of the dehumidifying and cooling unit located on each floor. This thermostat is actuated by the dry bulb temperature of the return air and it in turn actuates a damper motor attached to the face and by-pass dampers. In the damper motor is an auxiliary contact which operates a relay that in turn operates a magnetic circuit breaker in the spray water pump line so as to cut out the spray water pump motor when the face damper supplying cold air is completely closed.

(2) A thermostat which controls the opening and closing of the steam valve supplying steam to the heating coils in winter.

(3) A summer-winter changeover switch and thermostat which can be operated either automatically or manually. This thermostat operates a program motor which in turn reverses the operation of all

zone and room thermostats controlling the operation of the damper motors. The automatic arrangement can be cut out by means of a manually operated switch equipped with indicating lights. The switch has three positions: center position, which is automatic; right manual position, which is summer control with a white indicating light; and left manual position, which is winter control with a red indicating light.

(4) An indicating humidistat used for observation of humidity only. On the back of the panel is a small 110 volt, 6 watt indicating lamp which is cut out of the circuit when the humidistat indicator is moved to the correct point of return air humidity. This allows for an accurate determination of humidity.

During the first winter's operation it was determined that due to the unusual distribution of load as above described that it was very difficult to maintain comfortable conditions in the north zones during the coldest weather. This was caused by an uneven distribution of the air over the one steam heating coil located at the fan outlet. To remedy this condition, it was necessary to install a separate heating coil in the north zone duct with a separate control system consisting of a summer-winter changeover switch and thermostat, and a thermostat controlling the operation of the steam valve in the north zone duct independent of the operation of the steam valve in the other zones.

Since the basement presented such a wide variation in human load as compared to the rest of the building, a separate complete system of conditioning equipment with two air supply and return zones were installed. This installation uses the following controls:

(1) A sensitive thermostat, located in the main return air duct from which the north and south return air ducts branch. This micro-therm operates a damper motor controlling the operation of the face and by-pass damper. During the cooling cycle when the face damper is completely closed, it shuts down the compressor and evaporative condenser.

(2) Four additional sensitive thermostats located in the zone return ducts; two located in the south zone return duct and two in the north zone return duct. One sensitive thermostat in each zone return air duct is used for winter operation and one for summer operation. These sensitive thermostats operate the respective zone damper motors which proportion the amount of cold and by-passed air during the summer and heated and by-passed air during the winter.

(3) A thermostat located in the main return air duct which operates a steam valve during winter.

(4) A high limit control located on the discharge side of the heating coil which limits the discharge air temperature.

The operation of all equipment is started and stopped by means of an electric time clock. This clock starts two program motors, located in the basement, which in turn start the operation of all floor equipment and refrigerating equipment. The program motor starting the operation of the individual floor equipment starts the equipment on each floor step by step at about ten-second intervals. The program motor starting the operation of the refrigerating equipment starts first, the chill water pump, refrigerant pump, and evaporative condensers simultaneously. Then before any other equipment is started the chill water pump supplying chilled water from the water cooler in the basement to the baudelot coils on each floor has to draw full load current. This assures water circulation to all units. When the water pump draws full load current, it closes a current relay which in turn starts compressor number one. In turn, by-pass on number one compressor is operated; compressor number two, number two compressor by-pass; number three compressor, and number three compressor by-pass. When cutting out, the reverse order takes place. In event of current failure the units cannot restart until the program motors have reached their starting position again.

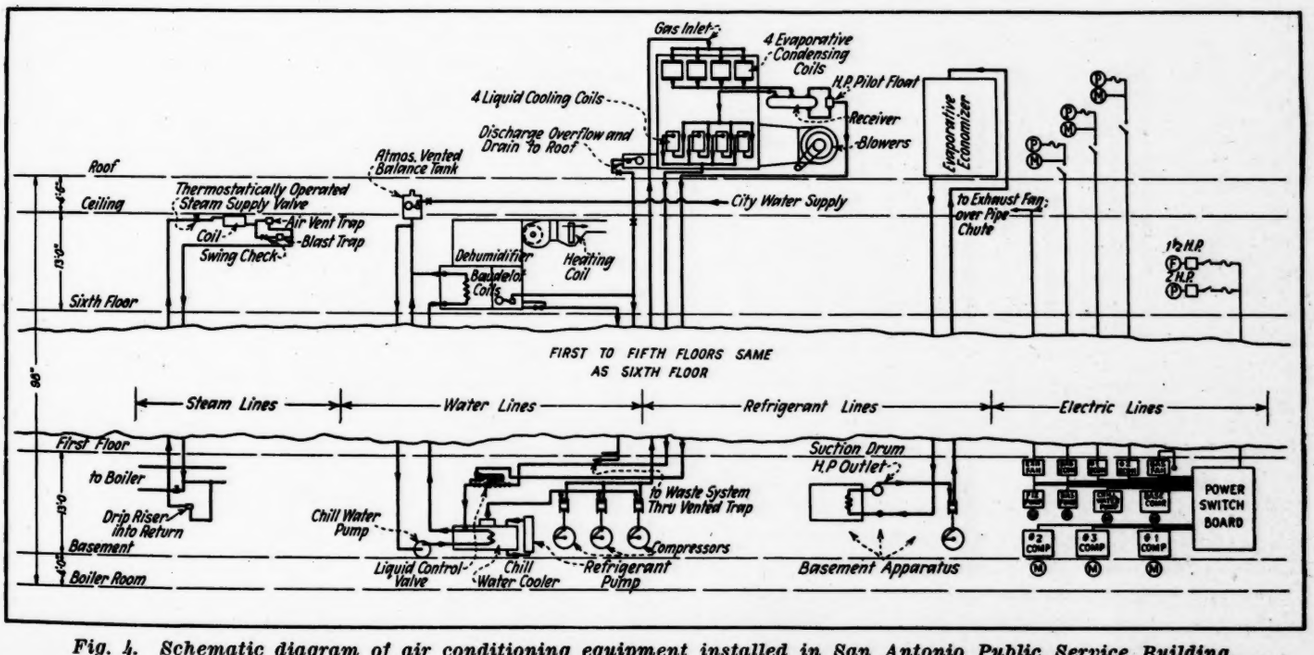


Fig. 4. Schematic diagram of air conditioning equipment installed in San Antonio Public Service Building. Note that steam, water, refrigerant and electric lines are grouped separately.

The Weak Spot in the Contractor's Business

By CHARLES R. ROSENBERG, Jr.†

THERE'S a weak spot in the heating and ventilating business that most contractors seem not to recognize, and, without warning, it may suddenly result in disaster and heavy loss.

The saying has become commonplace that the employes of a business make its success or failure. Somewhat less understood is the fact that every transaction between customer and employe is a potential legal danger point for the employer—as a California business man recently discovered to his sorrow.

This man had an employe who delivered merchandise and collected for it. For a certain regular customer he made out a faked sales slip with each delivery, showing a total larger than the correct amount. The customer relied on the amount shown in this faked sales slip and paid the money to the employe. Another sales slip showing the smaller and correct amount was turned in with the correct amount of money by the employe, who pocketed the difference.

The employer knew nothing of his employe's misconduct. Nevertheless, when the customer discovered the fraud, he sued the employer for the surplus amount which he had paid on the faked sales slips.

Was the employer legally and financially responsible? The California court thought so and said:

"A principal is liable to third parties not only for the negligence of his agent in the transaction of the business but also for the frauds or other wrongful acts committed by such agent in and as part of the transaction in such business. The employe in this case was authorized to make the collections, and each collection was made in the regular course of his employer's business and in connection with an actual delivery and sale. He was able to commit the frauds only because of his possession of the delivery truck and sales slips and because of the fact that he was regularly carrying on this part of his employer's business. In committing these wrongful acts he did not step aside from the business of his employer, but he used that business as a means to accomplish the fraud which was directly connected therewith. Although he exceeded his authority, he was not acting without the scope of his employment."

Thus the employer, who did not even know of his employe's conduct, had to pay back to the customer the entire amount out of which the dishonest employe had defrauded him.

The important point is whether or not the employe is acting within the scope of his employment when he commits the wrong. There is no hard and fast rule as to what constitutes "acting within the scope of the employment," for each case depends largely on its own circumstances. By and large, any wrong that an employe commits while on the job will have to be paid for by his employer.

Where an employe steps entirely out of character as an employe and beats a man for personal revenge, for example, the employer is not responsible. On the other hand, a contractor will have to pay the damages if his employe inflicts an injury upon a person while in the course of his employment, even though his act be the result of hot temper or poor judgment. The idea is that the employer is responsible for engaging such a person as his employe. The wrongful act of the employe does not need to be directly connected with his employment in order to make the employing contractor liable. Ordinarily, it is sufficient if the employe's wrong is committed while on the job or if it in some way arises out of his work.

Even the most discreet employe may commit a wrong unintentionally or through negligence or lack of skill. If an injury occurs through the negligence or clumsiness of an employe, the employer is legally and financially responsible just as much as if the employe wilfully and wantonly hurt the customer or other injured party.

"Wrongful acts" and "injuries" suggest physical violence. The employer is responsible for acts of violence committed by an employe in the course of his employment, but he is responsible for many other things too. The wrongful act might be some fraud on the customer. It might be false representations made to a customer in connection with equipment, charges or service. A hot-tempered, slanderous remark made by an employe to a customer in the presence of others would be a wrong for which the employer would have to pay. In general, the wrongs for which financial redress may be collected involve the violation of such inherent legal rights of an individual as his right to be honestly and truthfully dealt with, his physical security, and his good reputation.

Check prospective employes!

These few precautions will go far toward eliminating this legal weak spot.

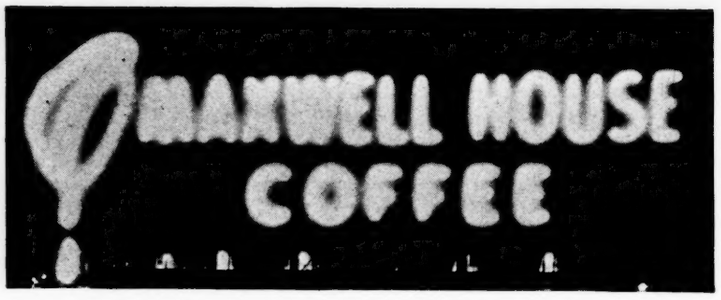
First, check prospective employes from the viewpoint of character, temperament, the ability to keep cool, and willingness to follow instructions.

Second, carefully instruct employes in all phases of dealings with customers and others.

Third, carefully check against allowing any employe to do a job for which he is not equipped, especially where such lack of skill might result in damage to other persons.

†Attorney-at-Law, Media, Pa.

A SECTION OF "HEATING & VENTILATING" SHOWING HOW
INDUSTRIAL PLANTS PROMOTE PROCESSES AND
SCIENTIFIC CONTROL OF



completes the world's largest coffee plant in Hoboken, N. J. High-pressure steam in convector type radiators and unit heaters employed to heat the buildings of the plant. Nutrition laboratories air conditioned.

By JOSEPH F. KERN, JR.

THE new coffee plant of the General Foods Corp., at Hoboken, N. J., is of interest to heating engineers principally because of its up-to-date, high-pressure heating system. This system with its convector type radiators, unit heaters, high-pressure piping and pressure type controls differs as much from the low-pressure industrial pipe coil radiator system of a decade ago as the up-to-date practically all-window plant does from the usual unattractive industrial plant of 20 years ago.

The plant, which fronts on the Hudson River between 11th and 12th streets in Hoboken, contains about 500,000 sq. ft. of floor space in seven buildings. The main structure, the Maxwell House Coffee and Tea and Sanka Coffee roasting plant, is six stories high and has its pier and warehouse directly in front of it on the river. On one side is a four-story building in which caffein is removed from Sanka coffee. Facing on Hudson Avenue is the new four-story General Foods Central Research Laboratory and Office Building together with a four-story can plant for the manufacture of canisters for Maxwell House and Sanka coffee. A separate boiler house which supplies the steam for manufacturing and heating completes the group.

The plant is equipped to perform all of the operations on the coffee from the time it leaves the freighter in the form of green beans until it is vacuum packed in canisters, placed in cartons and the cartons loaded on freight cars for shipment. The capacity of this plant is the equivalent of 1½ million cups of coffee each hour and 438 men and women are employed.

Coffee Manufacture

Green coffee is brought directly to the plant by ocean-going freighters and is stored in the warehouse until needed. The green beans are then mixed in blending drums, each of which holds 1½ tons of beans. From the blenders the coffee flows to coffee roasters which are the largest of their type ever built. After roasting, the coffee is spouted immediately to coolers beneath and from these passes to the grinders. From the grinders the coffee flows to automatic filling machines where the cans are filled at the rate of 85 a minute. The air is then removed and the cans are

sealed, packed into cartons and carried to the freight cars or storage space.

Sanka coffee, which is 97% free of caffein, passes through a slightly different process during which the caffein is removed. The caffein removed from the coffee is a white powder and is refined to U.S.P. anhydrous grade for the pharmaceutical trade.

Central Research Laboratory

The Central Research Laboratory is maintained to improve the products of the General Foods Corporation. There are approximately 100 men and women employed in these laboratories and they are continually studying methods of improving and reducing the cost of the various General Foods products. A few of the examples of research activities of this group include the development of the Vita-fresh method of packing Maxwell House coffee, development of the humidity air-tight wrapping for Post Cereal packages, development of new quick setting in Jell-O and also the improvement in New Minute Tapioca so that it requires only one-third the cooking time formerly needed.

Why High Pressure Heating Was Selected

When this plant was being designed, careful consideration was given to the type of heating to be used. It was finally decided to use a high-pressure heating system for the following reasons:

(1) There was a plentiful supply of high-pressure steam for heating as steam had to be generated at 125 lb. per sq. in. pressure to meet the needs of manu-

THIS INSTALLATION

Owner—General Foods Corp.

Location—Hoboken, N. J.

Engineers and Builders—
The H. K. Ferguson Co.,
Cleveland, Ohio

Heating and Piping Contractors—
Geo. J. Tobin, Inc.
Plainfield, N. J.
Frank A. McBride Co.,
Paterson, N. J.

Air Conditioning Contractor—
Blocker Air Conditioning Corp.,
Newark, N. J.

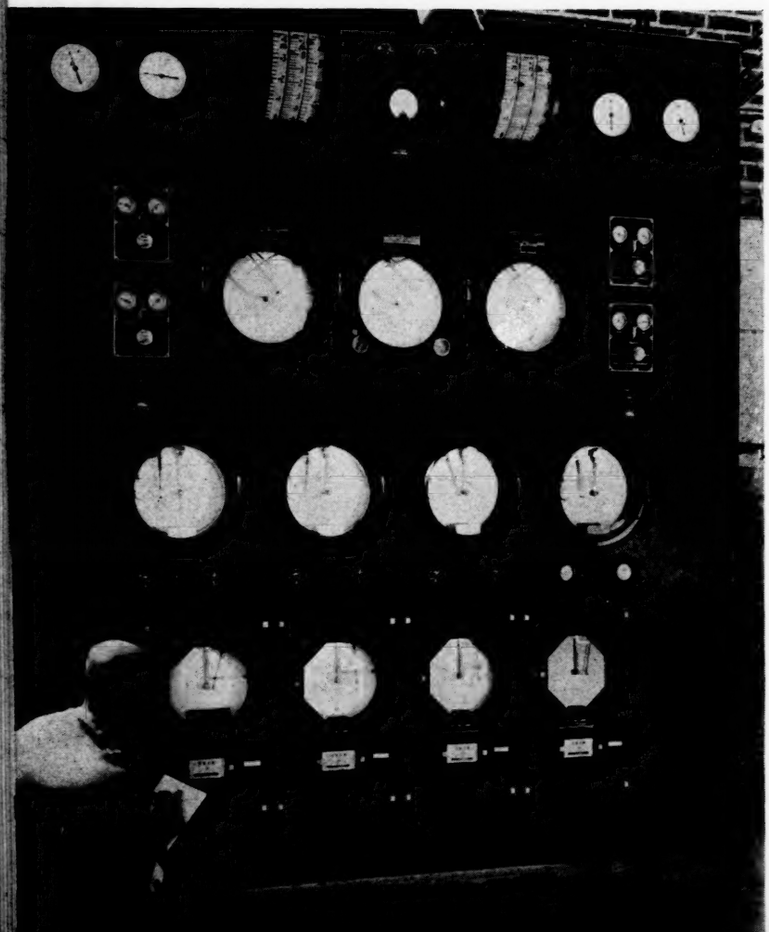
Aerial view of the Maxwell House, Sanka and Kaffee Hag Coffee plant, Hoboken, N. J.

One of the two 125 lb. pressure, oil fired boilers which are used for supplying steam for process work and heating.

facturing operations; (2) as the walls of the plant are practically all glass, there was not enough space to mount the usual low-pressure radiators; (3) because a high-pressure heating system made possible the use of comparatively small steam piping and tube and fin convectors instead of cast-iron radiators, the cost of installation would be substantially lower than for a low-pressure system; (4) a high-pressure system would make possible the use of a simple control which varies the pressure in the system in accordance with the outside weather conditions; (5) because the system could be easily controlled it was felt that there would be an appreciable saving in operating cost since it would not be necessary to open windows to decrease excessive temperatures.

Although there are seven buildings in the plant, only the coffee roasting building, can manufacturing building and Research Laboratory and office building are heated. The boiler house and caffein extraction building have an excess of heat at all times while the storage building and covered piers require no heat since the coffee is not affected by temperature.

Instrument board in the boiler house. Board is divided in half, each half containing a complete set of instruments for one boiler.



Heating Equipment

Steam is generated at 125 lb. pressure in two oil-fired boilers. Steam for heating of the buildings is reduced to approximately 30 lb. pressure by a diaphragm operated, pressure reducing valve before it is distributed to the various buildings. The boiler plant is equipped with all modern controls and instruments to insure efficient operation. For example, to indicate the discharge of smoke, a smoke indicator is provided. This instrument shows at all times the amount of smoke or haze being discharged.

In all of the heated spaces except the shipping floors heating is by high-pressure convector type radiators. These radiators are made of a heavy copper tube arranged in the form of a continuous coil to which are mechanically bonded a series of steel plates. They are designed so that the surface of the radiator which is subjected to being touched by a person, is at a comparatively low temperature, thus eliminating the possibility of anyone being burned. The radiators used in

Coffee tasting room showing C. W. Lawson, one of General Foods' expert coffee tasters sampling a batch of Maxwell House coffee. Underneath the window can be seen one of the high pressure radiators used in heating the plant.

this installation are practically all of the wall hung type and occupy only a comparatively small space because of their high heat emission.

Control System

All high-pressure radiators have their heat output controlled by varying the steam pressure. In the boiler room is a pressure recording control instrument which operates compressed air type reducing valves in each building. These valves furnish a simple means of varying the steam heating pressure and make possible the maintenance of proper temperature in the plant at all times.

On the shipping floors, unit heaters are employed because of the large amount of infiltration when the shipping doors are open. These heaters are also of the high-pressure type using steam at 30 lb. pressure but they are controlled by individual thermostats. The thermostats are arranged to control the operation of the fan on the unit heater.

Water Heating

A considerable amount of hot water is necessary for the manufacturing processes and cleaning. This hot water is supplied by low-pressure type storage water heaters. Steam is supplied to the water heaters by a pressure reducing valve at approximately 5 lb. pressure.

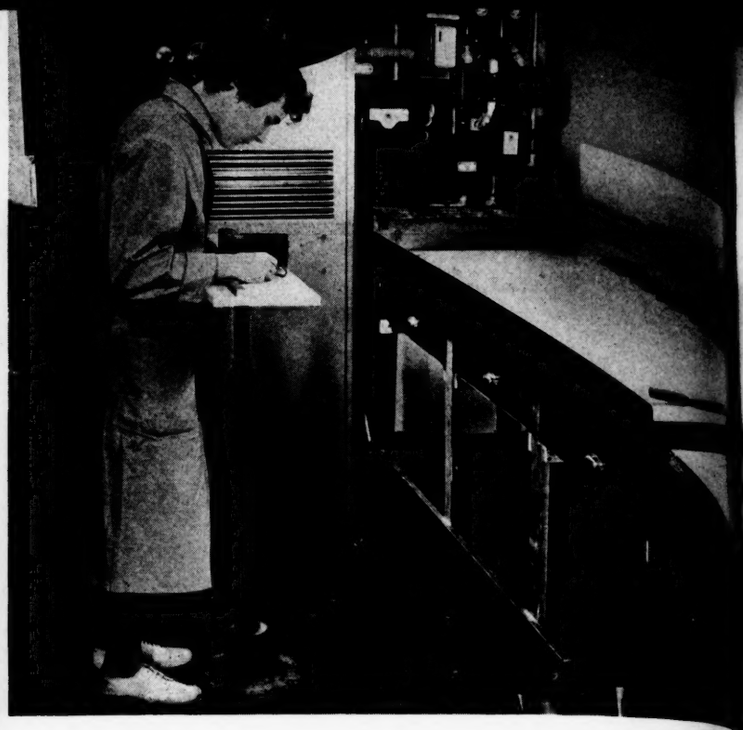
Air Conditioning

In the Central Research building a number of small animals are kept for test purposes. In order to eliminate any variation in the test result due to changes in weather, an air conditioning system is employed to maintain constant conditions within this room. This system also serves to keep the animals in the best possible health at all times. The system employs a 10-ton F12 condensing unit and a direct expansion cooling coil. The equipment is located in a small machinery room next to the nutrition laboratory in which the animals are kept.

In the Central Research Laboratory building there are a considerable number of chemical laboratories which require exhaust systems for the removal of chem-

Exhaust stacks which exhaust fumes and smoke from coffee cleaning and roasting equipment. Each exhaust has a specially designed dust collector for preventing discharge of solid matter from the stacks.

A view in the packing department of the Maxwell House division showing one of the machines which hermetically seals the containers of Maxwell House coffee.



A corner of the food laboratories. The technician is making a camera record of samples of jelly. In the background is one of the unit type air conditioners employed for maintaining constant conditions in the laboratory.

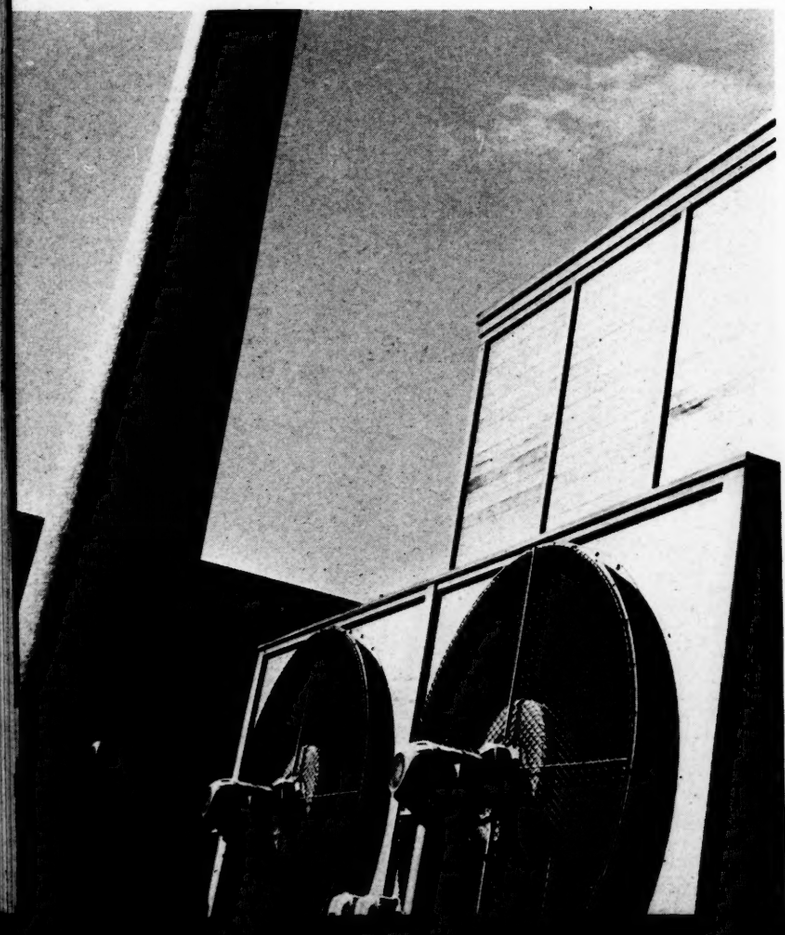
ical fumes. These exhaust systems are of the usual laboratory type and discharge into the outer air at the roof.

Dust Collectors

A considerable amount of chaff and other waste products are discharged from the coffee roasting ovens while the coffee is being heated. In order to prevent this material from getting into the outer air all of the exhaust stacks from the ovens have a specially designed dust collector installed in them. These collectors are of a new type and remove practically all of the solid material from the exhaust gases.

Cooling Tower

Approximately 1000 gal. of water is required each minute for cooling purposes both in the Sanka Coffee manufacturing process and by the high-vacuum pumps which remove the air from the coffee containers before the lids are sealed on. This water is supplied by a double fan cooling tower installed near the power plant.



1000 gallons a minute of cooled water is supplied by this double fan cooling tower. Water is employed for cooling operations in the Sanka caffein extract building and for cooling the high vacuum pumps which exhaust the air from the coffee containers before they are sealed.

BUILDING INDUSTRY

THE HAUGHTON ELEVATOR CO.

modernizes its heating plant, insulates the roof and installs gas-fired unit heaters. Fuel cost estimates were bettered during the first year of operation.

PROFITS IN AIR

NO. 4 OF A SERIES SHOWING HOW INDUSTRIAL PLANTS PROMOTE PROCESSES AND PROFITS BY SCIENTIFIC CONTROL OF AIR CONDITIONS

AMONG the gas-fired installations put into major industrial plants in the past few years is the huge unit heater job, which has now rounded out its first full year of service in the 76,000 sq. ft. single-room structure housing all the manufacturing operations of The Haughton Elevator Company at Toledo.

The factory is essentially a wood and steel structure 358 ft. in length by 215 ft. wide with a lengthwise central monitor bay or main craneway 33 ft. high and 52 ft. across. The east and west bays on either side are 17 ft. high and house such partitioned-off rooms as the paint shop, generator room, cafeteria, pattern shop, toilets and washrooms, blacksmith shop, testing tower, millwrights booth, and shop office. On part of the roof of the west bay is the pattern storage. Roofs are flat (except for one saw-tooth running the full length of each side bay to provide for 12-ft. near-vertical skylights), and consists of pine sheathing covered with composition roofing. The side walls of the monitor bay are vertical and all glass, whereas all other walls are brick for the first 4 ft. from the ground and largely glass with about 5% of wood and siding for the

THIS INSTALLATION

Owner—
The Haughton Elevator Co.
Location—
Toledo, Ohio
Consulting Engineer—
S. R. Lewis, Chicago.

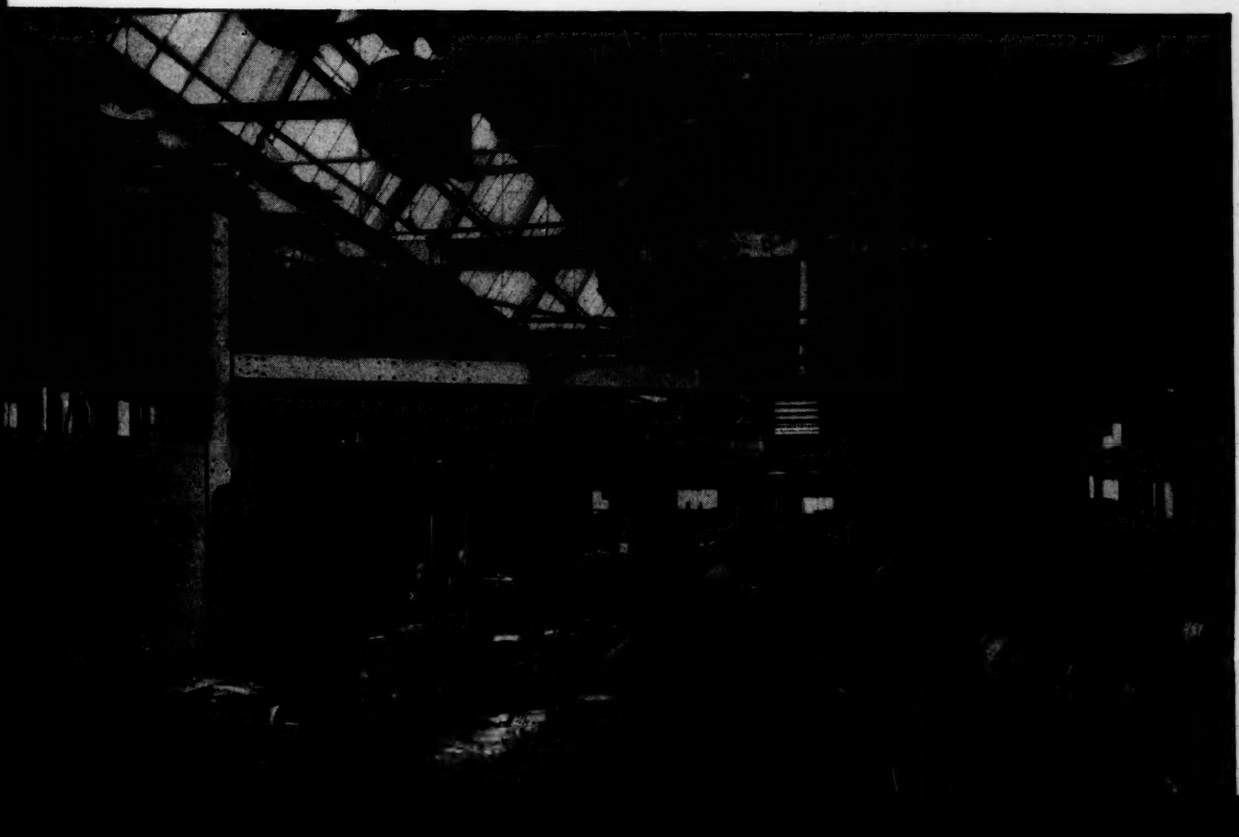


Fig. 1. Interior of the Haughton Elevator Company shop showing one of the side bays. Note the insulation on the roof and one of the 41 unit heaters to the right of the center.

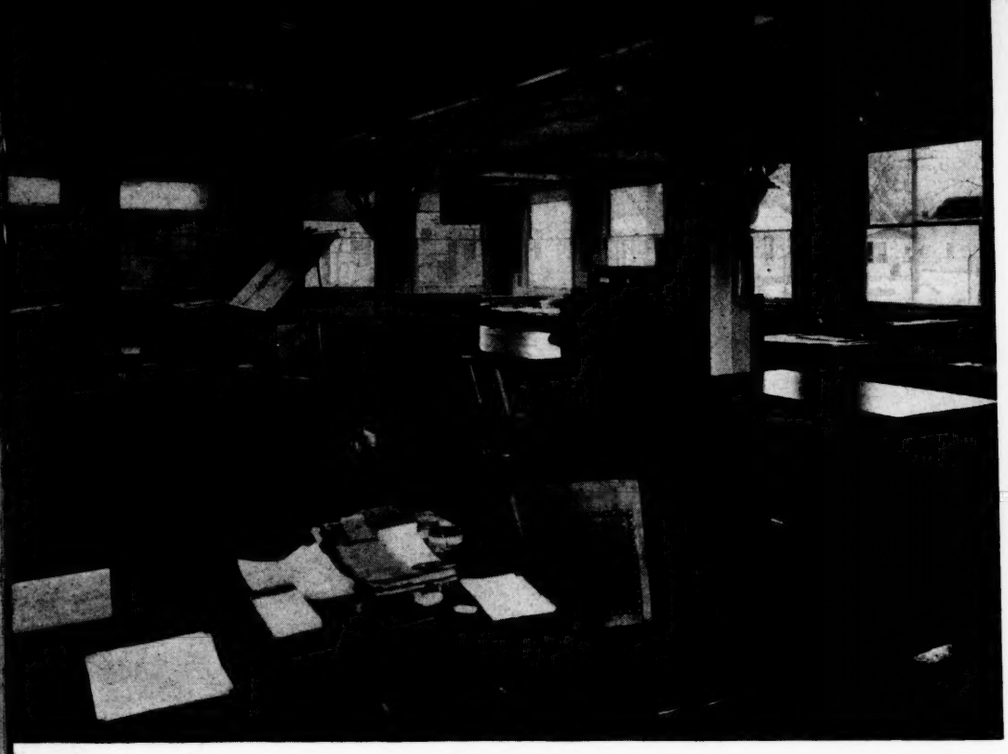


Fig. 2. Drafting room and engineering office in the plant of the Haughton Elevator Company. Note the unit heater in the center.

remaining distance. The floor in the west bay consists of 10 in. of concrete, and in the east bay of 9 in. of concrete with 3 in. of wood flooring. The flooring in the monitor bay is 12 in. of concrete topped with ½ in. of sand and 3 in. wood blocks. Thus it is seen that the spaces involved in the Haughton plant are tremendous and that the thermal insulation naturally offered by the construction is very poor. Further, there is virtually no part of the plant where men are not regularly at work during even the coldest of winter days.

Before the new unit heater installation was made, the structure was heated by ten batteries of duplex coal furnaces with individual blowers and horizontal warm air outlets at least 8 ft. above the floor. Stoking was by hand from wheelbarrows of coal, and ash handling and maintenance involved much labor. The effect of the furnaces upon the cleanliness of the plant was serious. Actual Haughton cost department records show that the operation and maintenance of the old furnaces cost $4600 to $4750 per year (coal, invoice cost plus freight plus unloading, $3300 to $3400—labor and power, coal handling plus firing plus ash removal plus power for blowers, $700 to $750—repairs and maintenance, $600). The average operating cost per degree day below 60F, corresponding to a shop temperature of 65F, during the period throughout which the furnaces were used, varied from $0.89 up. In the winter 1937-38 the figure was $1.04.

This was the knotty problem faced by the heating engineers when they tackled the Haughton job in 1938.

Low Firsts and Operating Costs Obtained

Several modern means of heating factory spaces of this magnitude were considered when the problem was first taken under engineering consideration, that which at first indicated the lowest operating costs proving to be a large coal-fired boiler installation supplying a hot water unit heater system. However, the initial cost of such a system would have been $35,000. It was then disclosed that if $7000 were spent in insulating the roof with 4 in. of insulating wool, the maximum heat losses of the building could be radically reduced to between 4 to 4½ million B.t.u. per hour and a $10,000 installation of gas-fired unit heaters would be able to operate as required for as low a cost as the coal boiler installation. The unit heater contract was signed, and work was begun on what is believed to be one of the ten largest single-room unit heater installations and one of the very largest industrial roof installation jobs ever made.

Some 80,000 square feet of roof and monitor end walls were insulated with 4 in. of insulating wool in bats 15 in. wide by 36 in. long. It was installed between the joists with chicken wire strung underneath for additional support. A dead air space was left between the insulation and the wooden roof. The effect was not only to reduce the initial and operating costs of the gas-fired unit heater system, but to reduce the noise in the plant (chiefly developed by line shafting) by at least one-half, and to make working conditions perceptibly pleasanter (cooler) during summer months. As a matter of fact, it is reported that with the insulated roof and air circulation created by operation of unit heater fans, summer temperatures are lower in the plant than in the office building which adjoins it.

The unit heaters, 41 in number, are throughout the entire plant as shown by the accompanying floor plan (Fig. 6). Each of 19 consumes 81 cubic feet of 1050 B.t.u. per cu. ft. natural gas per hour; each of 13 consumes 152 cu. ft. of gas per hour; and each of 9 uses 190 cu. ft. per hour. All heaters are suspended approximately 7 to 8 feet from the floor and their louvers are directed downward to throw the warm air toward the floor, the machines and the workmen. A test made on a cold December day showed a temperature variation from floor to crane bay ceiling of less

Fig. 3. Down the length of the main Craneway indicating the tremendous spaces involved and showing part of the roof insulation.

Fig. 4. Stock room in the Haughton Elevator plant showing two unit heaters and the insulation in the roof.

than 5F, a good indication of the type of circulation achieved.

Considerable money was saved in gas service lines by good piping lay-outs, and in the flue connections by providing H-type triple tee down-draft arrestors of 20-gage galvanized steel at least 2 ft. above roof level and atop each unit heater flue. Were these not provided it would be necessary to run many of the flues at least 15 ft. higher to clear the main craneway roof level and avoid serious down-drafts. Also, the arrestors eliminate *pulling* effects due to cross-drafts, and insure the stablest of firing conditions within the unit heaters.

Transite flues were used throughout using 5 in. diameter for the smallest size heaters, and 7 in. diameter for the rest. About one-tenth mile of this pipe was used in making the installation. Although their initial cost was slightly greater than for other types of flues, they are expected to last almost indefinitely, never to corrode, and to impose a minimum weight strain (as compared with cast iron flues) on the roof and flue supports. In accordance with best practice and fire underwriter's rulings, flues were passed through the roof so as to provide a 1½ in. air space between them and their flashed metal roof jacks. Also, cemented to each flue, is a rain-shedding petticoat of galvanized sheet metal.

Special Hook-ups

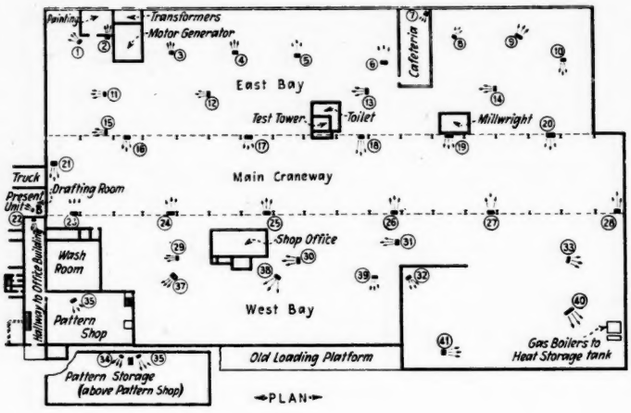
Interesting and special installation adaptations were made in the case of three of the 41 unit heaters (Nos. 2, 7 and 21 on the accompanying plan). That which supplies the paint room (No. 2) is located outside of that room, the warm air being conducted through the wall and suitably directed within the paint room by special sheet metal ducts. Because of the volatile nature of the paints and lacquers sprayed within this room, a fire screen is located below the heater's burner and across the air inlet. In the lunch and recreation room (No. 7) the inlet zone of the heater is ducted to within 12 in. of the floor to preclude inadequate circulation or cold floor conditions in this space where employees are at rest. The third especially fitted heater (No. 21) is located above and beside the inner and vertical lifting door of the truck vestibule. This unit is equipped with a fan-shaped high velocity nozzle which plays a sheet of warm air across the large truck door opening when it is in use, and, thus, forms a warm air screen against excessive cold air infiltration.

Each of the 41 heaters is individually controlled by a thermostat located 5 ft. from the floor and almost directly below the unit it controls. Also each heater is equipped with a device which definitely will not permit the gas to be turned on until that device is impelled by the force of the air driven by the fan. Thus, the fan must be running before heating can occur, and as a result no failure in the fan circuit can cause overheating of the unit due to inadequate circulation.

It is also to be considered that other heat developing units are operated in the Haughton factory. Forge furnaces are busy at the job of forming brackets; heat treating furnaces are putting all manner of elevator parts through exacting temperature cycles; a large boiler converted to use gas is tempering against freezing the large volumes of water stored high in the sprinkler system tank tower outside; two gas unit heaters installed some time before the 41 discussed here are heating the drafting room which communicates to the main bay; a gas-fired boiler is supplying steam heat to the company's main office building which adjoins the plant; several pot furnaces are doing hardening or melting jobs; and welding torches and soldering furnaces are all contributing their mite to the sum total of *extra* heat sources. With an installation other than one of unit heaters which force circulation of air down from above, all this uncontrolled extra heat would rise to the top of the lofty crane bay and be lost to the comfort heating cause.

Fig. 5. Unit heater No. 2 shown in the upper right supplies the paint room from outside that room and is fire screened at the inlet air duct. Note flue connection.

Fig. 6. (Below). Plant layout, showing location and directioning of unit heaters. Fig. 7. (Right). Heater No. 21 plays a sheet of warm air just inside the inner truck vestibule door to form a screen against excessive cold air infiltration at the time of deliveries to and from the plant. Note also the insulation above doors and windows.



Anticipated Costs Beaten

Since its first day of service, the modernized Haughton Elevator plant heating system has been adjusted to maintain 65F for 55 hours per week (five 8-hour days, plus one 3-hour-day, plus 2 hours to heat up on each of the 6 days), and to hold 55F for the remaining 113 hours. This schedule of plant temperature conditions was settled upon, not only after consideration of the particular requirements of the workmen, the plant and the equipment, but also after consideration of the estimated economics of maintaining several temperature schedules ranging from the minimum acceptable to the maximum reasonable conditions. Some of these estimated costs were as follows:

(A) 70F constantly.....$5565 per season
(B) 65F constantly..... 4925 per season
(C) 60F constantly..... 4240 per season
(D) 70F for 40 hours—45F for remaining time ..... 4055 per season
(E) 65F for 40 hours—45F for remaining time ..... 3765 per season
(F) 60F for 40 hours—45F for remaining time ..... 3430 per season
(G) 65F for 55 hours—55F for remaining time ..... 4412 per season

The method of calculation of these data is shown in Table I, which pertains to Case G cited above and the heating schedule actually selected.

Noteworthy is the fact that the actual gas bills received from October 28, 1938, to June 8, 1939, totalled only $2095, or 47% of the expected amount. Part of this difference is due to the fact that, during the period noted, Toledo experienced only 4549 degree days below 60F instead of the 1933-1938 average of 5161 upon which calculations were based. Even so, the comparison in Table II shows an actual cost *per degree day* of $0.461, or 54% of the estimated amount.

This discrepancy between estimated and actual figures is not unexpected in view of the liberal allowances which were provided in the calculations of building heat losses and unit heater thermal efficiency.

There have been no upkeep, labor, or servicing charges, and none are expected for years to come. Further, the cost of electricity for operating the fans incorporated in the unit heaters is liberally estimated at $80.80 (the smallest heaters carrying 1/12 hp. motors, and the medium and largest carrying ¼ hp. motors). Therefore, the total heating season cost for 1938-1939 has been $2175.80, a clear 53% savings over the minimum cost of the old arrangement.

The heating plant was designed by S. R. Lewis, Chicago, in collaboration with Haughton's engineering department and with Charles C. Eeles, industrial engineer, The Ohio Fuel Gas Co.

TABLE I

COMPUTATION OF CORRECTION FACTOR FOR INTERMITTENT OPERATION:

55 hrs. per wk. × 65F.....3575 degree hrs.
113 hrs. per wk. × 55F.....6215 degree hrs.
Total per wk. .....9790 degree hrs.

$$\text{Correction Factor} = \frac{\text{Total degree hrs. in period}}{\text{Days in period} \times \text{Max. Operating Temperature}}$$

$$= \frac{9790}{7 \times 65} = 21.5$$

COMPUTATION OF ESTIMATED ANNUAL GAS CONSUMPTION (HEATING ONLY IF OUTSIDE TEMPERATURE BELOW 60F):

$$\text{Consumption} = \frac{\text{Hourly Heat Loss} \times \text{Degree Days Above 60F} \times \text{Corr. Factor}}{\text{Max. Operating Temperature} \times \text{B.t.u. cu. ft. of Gas} \times \text{Efficiency}}$$

$$= \frac{4{,}500{,}000 \times 5161 \times 21.5}{65 \times 1050 \times 0.83} = 8{,}825{,}000 \text{ cu. ft. per season}$$

Cost = 8,825,000 cu. ft. at $0.50/1000 cu. ft. = $4,412.50.

TABLE II

	Estimated	Actual (Oct. 28 to June 8)
Degree Days Below 60F.....	5161	4549
Cubic Feet of Gas	8,825,000	4,190,000
Billed Cost	$4412.50	$2095.00
Cubic Feet per Degree Day.....	1708	922
Cost per Degree Day.....	$0.854	$0.461

IRON

INDUSTRY

WOODWARD IRON CO.

is successfully operating the first air conditioned blast furnace. The purpose of the 535 ton installation is to control the moisture content of the air blast.†

PROFITS IN AIR

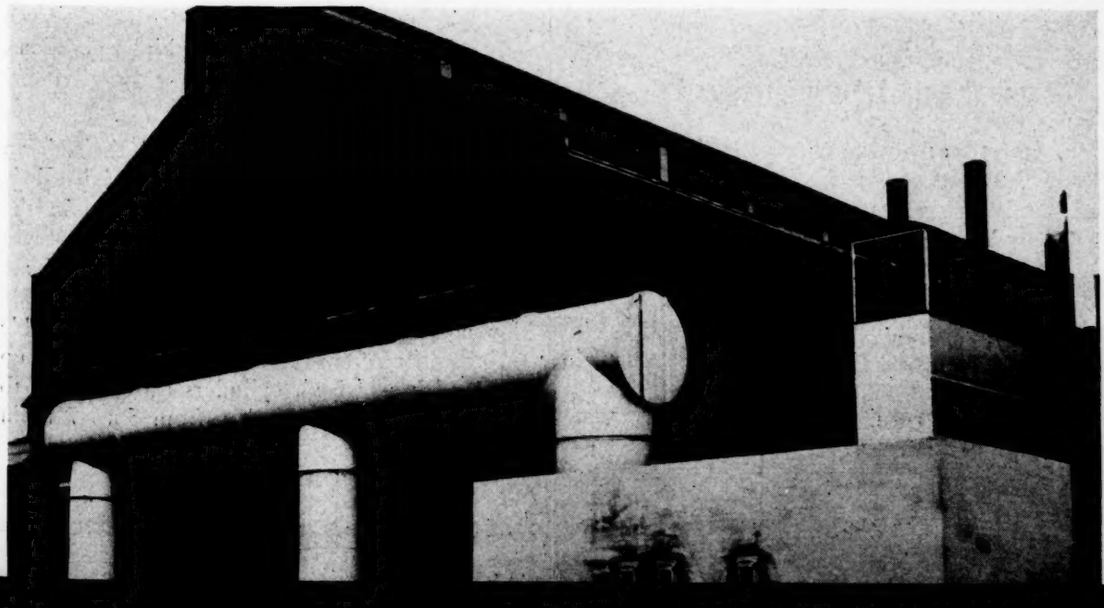
NO. 5 OF A SERIES SHOWING HOW INDUSTRIAL PLANTS PROMOTE PROCESSES AND PROFITS BY SCIENTIFIC CONTROL OF AIR CONDITIONS

THE first air conditioned blast furnace is now successfully operating at the plant of the Woodward Iron Company at Woodward, 12 miles southwest of Birmingham. The 535-ton installation was made at an estimated cost of $75,000.

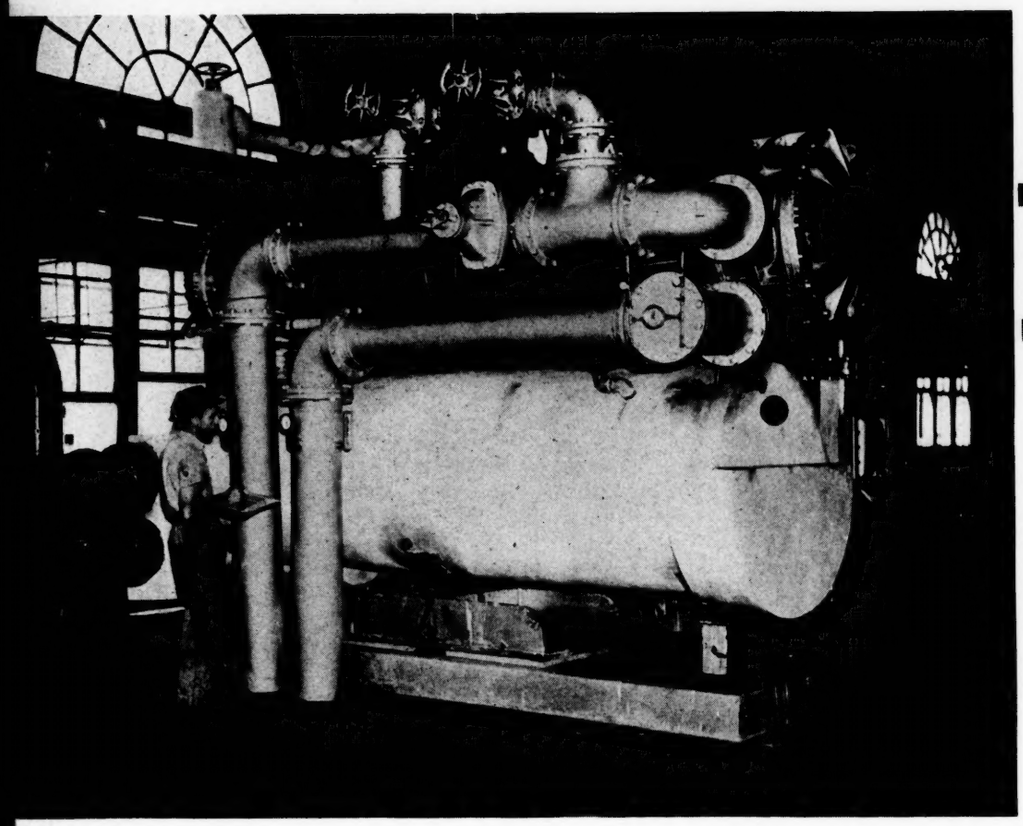
The primary object of the installation is to control the moisture content, summer and winter, of the air blast required in blast furnace operation to the end that a more uniform product can be produced. The value of having a dry blast in the process has long been recognized, but the Woodward Company was the first to turn to modern air conditioning to attain this objective. The capacity of the furnaces at Woodward is 400 to 550 tons of iron per day, and the air required is from 45,000 to 50,000 c.f.m., or about 2700 tons of air per day. Thus for every ton of iron produced, 5.6 tons of air must be conditioned.

In smelting, the principal functions of the furnace are to dry the charge, release the calcium from the carbonates, reduce the metallic oxides in the ore, and to melt the iron. To accomplish these objectives, air is blown into the furnace where the combustion of the coke results in a temperature of around 3000F. Carbon

†This article is based on information obtained from George H. Watson, Birmingham, Ala., and from a paper by L. L. Lewis, Vice-President, Carrier Corp., presented at the Eastern Air Conditioning conference, Lehigh University, sponsored by the American Society of Refrigerating Engineers and others.



Spray dehumidifier at Woodward Iron Works. Outside air taken in through stack rising from roof at right end of spray chamber. Suction line carrying cooled and dried air runs to left and thence underground to blowing engines



535-ton centrifugal refrigerating machine at Woodward Iron Works. The compressor is driven by a steam turbine, the speed of which is automatically controlled to maintain the leaving chilled water at a constant temperature regardless of the load on the machine.

dioxide is formed but immediately broken down into carbon monoxide which is a powerful reducing agent. As mentioned, amounts of air required are very large and in order to operate economically the air is preheated.

Description of Plant

Ordinarily outside air passes through large blowing engines into a series of stoves where the air is preheated to about 1300F and then enters the furnace. In the Woodward installation the air before being heated and blown into the furnace is passed through a two-stage dehumidifier where chilled water is sprayed through the air stream at many successive intervals. The chilled water is supplied by a 535-ton centrifugal refrigeration machine.

Water from the refrigeration machine enters the dehumidifier at a temperature of 38F; air leaves the dehumidifier at a dewpoint temperature of 42F, when it contains 3 grains of moisture per cubic foot. In the winter a standard closed water heater is employed to heat the water circulated through the dehumidifier. The dehumidifier thus becomes a humidifier when the outside air is below 42F dewpoint. Automatic controls regulate the speed of the 600 hp. condensing turbine driving the compressor so as to regulate the dewpoint of the air leaving the dehumidifier.

The dehumidifier is a reinforced concrete house with top, bottom and sides 12 inches thick, and with all internal surfaces water-proofed. This rugged construction was considered necessary to withstand the intense pulsations set up by the reciprocating blowing engines. Under these unusual conditions extra sprays were provided in order to secure the complete dehumidification desired.

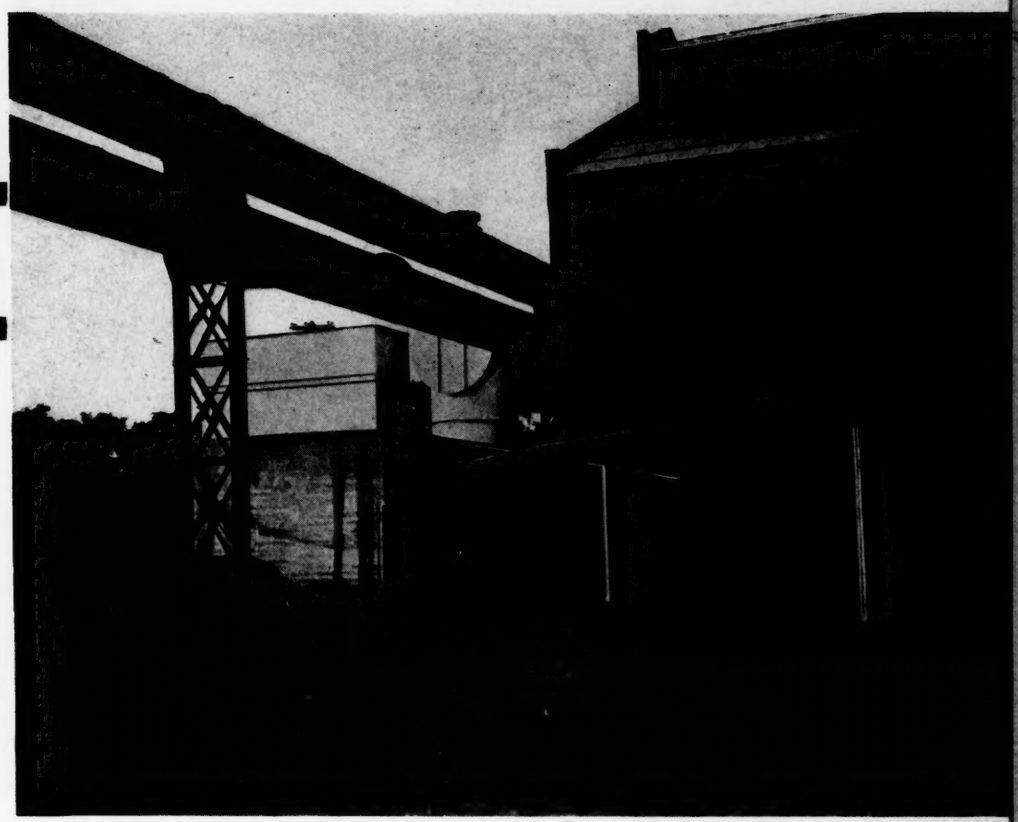
A blast furnace has to operate 24 hours a day, and in order that the dehumidifier can be properly maintained, provisions were made to shut off a few sections at a time without interrupting operation. All water screens and strainers are removable, so that they can be cleaned and replaced without disturbing operations.

Pulsations of Blast

Air from the dehumidifier is delivered through an 8-foot diameter duct to the blowing engines. The air is compressed to approximately 20 lb. pressure in the blowers, then forced through the pre-heating stoves and heated to 1300F before being delivered to the blast furnace.

The blowing engines are large, two-cylinder, double acting, reciprocating compressors which turn over up to 80 r.p.m. and in which air cylinders range from 7 to 9 ft. in diameter and with strokes from 5 to 7 ft. in length.

IN AIR > >



Intake view of dehumidifier with brick pump house at right. Chilled water mains pass through the wall of pump house and run off to the right to centrifugal machine. Cold blast mains carrying air at 15 lb. pressure pass through the wall of blowing engine house to the left. The water on dehumidifier is condensate from the suction main.

The pulsations from the blowing engines are of considerable magnitude. At a point near the cylinders of the Woodward blowing engines a pulsation of 12 in. water gauge (61 lb. per sq. ft.) was observed. These waves are felt through the entire system and it was necessary to add strong channel iron bracing to the outside air intake.

Dew Point Important

Selection of the final dew point at which moisture is to be removed was the essence of the economic and design problem. Initial conditions were fixed by local weather conditions. Of equal importance, though, was the usage factor which is composed of, among other things, the number of months of the year during which the plant can be used for obtaining regularity and the tons of moisture which can be removed from the wind during a year's operation.

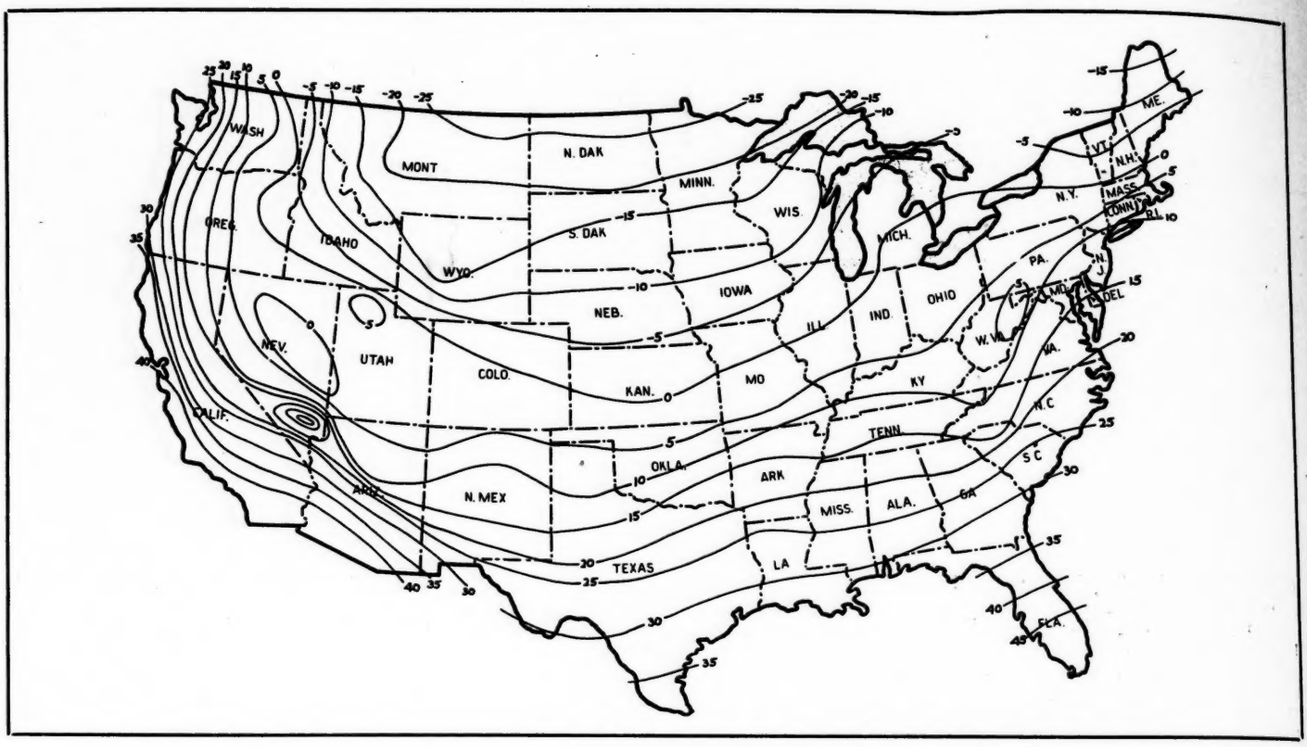
Lowering moisture in the blast reduces the amount of coke which must be burned for each ton of iron produced and increases the total output which can be obtained from a furnace. One grain per cubic foot accounts for about 48 lb. of coke per ton of iron; a little more than six grains, therefore, about 300 lb. of coke per ton of iron.

The dry blast plant was put in operation in the latter part of June. The response of the furnace to drier wind was immediate and impressive. Burden was promptly increased. A noteworthy reduction in coke per ton of iron followed promptly and the silicon content of the iron also responded to the lowered moisture content. The prime objective of the installation is to be able to produce a uniform quality of iron. Control of the humidity is achieving that result. Prior to this installation chief advances in blast furnace practice were in the preparation of the raw materials and proper charging of the furnace. Yet these heavy raw materials do not total the tonnage of air used; hence, the explanation of why the company turned to a conditioning of the air.

Second Installation Under Way

Air conditioning of a second blast furnace at the Woodward plant will start immediately, according to an announcement made late in November by H. A. Berg, president of the company. The second furnace is expected to be ready for operation within 90 days.

While President Berg has made public no figures as to the performance of the equipment, decision to proceed with the second furnace is taken as evidence that the installation has proved satisfactory in its major purpose of affording a more uniform product through scientific control of heat, moisture and air blast.



Zones of equal severity in extreme winter weather. The isotherms indicate the daily mean temperatures which may be expected on an average of once a year.

A Basis for Selecting Design Temperatures for Winter Heating

Based on an analysis of weather data for 120 cities, Professor C. M. Humphreys of Carnegie Institute of Technology recommends that the frequency of recurrence of low temperatures should be the basis for selecting winter design temperatures. The author's conclusions, a table and a map are presented here, reproduced from a recent publication by Professor Humphreys.

IT has been frequently pointed out that the proper design temperature for winter heating installations cannot economically be the lowest reported temperature in a given locality, inasmuch as this lowest recorded temperature is reached only once over a long period of years. One of the standard rules for selecting the design temperature is that it should not be more than 15F above the lowest reported temperature, but a more specific delimiting has never been determined by any formula or rational procedure, nor has it been a matter easily susceptible to fixing.

In order to provide a basis for selecting heat design temperatures, an analysis of winter data for 120 cities was recently made by Professor Clark M. Humphreys of the Carnegie Institute of Technology assisted by workers furnished by the Works Progress Administration and reported in a publication by Professor Humphreys and entitled "An Analysis of Winter Temperatures for One Hundred and Twenty Cities," published by the Carnegie Institute of Technology as Bulletin 82.

In making his study, Professor Humphreys used the climatological data of the United States, by sections, as published by the Weather Bureau, and which contain considerable data for many cities over a long period of years. Professor Humphreys selected 23 years as the average number of years' data on which to base his study. The study included analysis of both daily minimum and daily mean temperatures and the analyses of both are presented in the bulletin.

The general plan followed in the study was to show the frequency with which certain minimum and mean temperatures may be expected to occur, and it is the author's opinion that the probable frequency of recurrence is the important consideration in selecting design temperatures.

Important among the data presented in the bulletin is a table, reprinted here, showing the average number of times per year, during the period studied, that the daily minimum and daily mean temperatures were as low as or lower than the temperatures indicated in the body of the table. Frequency of recurrence ranging from once in three years to five times per year is included.

As an example of the use of this table it is shown that in Birmingham, Ala., a daily minimum temperature of 8F or lower occurred on the average of once every two years. A daily mean temperature of 18F or lower occurred with the same frequency. A daily mean temperature of 17F occurred on an average of three

AVERAGE FREQUENCY OF RECURRENCE OF DAILY MEAN AND DAILY MINIMUM TEMPERATURES

(Showing the average number of times that daily temperatures have been as low as or lower than the temperatures indicated)

STATE AND CITY	AVERAGE FREQUENCY OF RECURRENCE													
	Once in 3 Years		Once in 2 Years		Once per Year		Twice per Year		3 Times per Year		4 Times per Year		5 Times per Year	
	TEMPERATURES, F													
	Minimum	Mean	Minimum	Mean	Minimum	Mean	Minimum	Mean	Minimum	Mean	Minimum	Mean	Minimum	Mean
ALABAMA														
Birmingham	7	16	8	18	11	21	15	25	17	26	19	28	20	29
Mobile	18	27	19	28	22	30	24	33	27	35	28	36	29	38
ARIZONA														
Flagstaff	−18	2	−17	3	−14	6	−11	8	−8	10	−6	12	−5	13
Phoenix	24	38	25	39	26	40	27	41	28	42	29	43	29	43
Yuma	29	39	29	40	30	42	31	44	32	45	33	46	33	46
ARKANSAS														
Fort Smith	−3	9	1	12	5	15	9	18	12	21	14	22	15	23
Little Rock	5	13	6	15	9	18	12	20	14	22	16	23	18	25
CALIFORNIA														
Eureka	25	33	27	34	28	36	29	37	31	38	31	39	32	39
Fresno	24	32	25	33	27	35	28	36	29	37	29	38	30	38
Los Angeles	35	42	36	42	37	43	38	45	39	46	40	47	40	47
San Francisco	33	38	34	39	35	40	36	41	37	42	38	43	39	44
COLORADO														
Denver	−16	−7	−14	−6	−11	−3	−8	1	−5	5	−3	7	−1	9
Durango	−19	0	−18	1	−15	3	−12	6	−10	8	−8	9	−7	10
Grand Junction	−17	−1	−16	0	−12	2	−9	4	−6	7	−4	9	−2	10
Trinidad	−18	−2	−16	1	−9	4	−5	9	−3	11	−1	13	0	15
CONNECTICUT														
New Haven	−8	1	−6	3	−3	7	1	10	3	12	5	13	6	14
FLORIDA														
Jacksonville	21	30	22	32	25	35	28	37	30	39	31	40	32	41
Tampa	28	40	30	40	33	43	35	45	36	46	37	47	38	48
GEORGIA														
Atlanta	5	15	6	16	11	20	14	23	16	26	18	27	19	27
Savannah	18	26	20	28	22	32	25	35	27	36	28	37	29	38
IDAHO														
Lewiston	−15	−4	−13	−3	−10	0	−5	4	0	8	3	11	5	12
Pocatello	−20	−9	−18	−8	−16	−6	−11	−1	−8	3	−6	5	−4	7
ILLINOIS														
Cairo	−4	4	−2	5	1	9	4	12	7	14	9	16	10	18
Chicago	−14	−6	−13	−5	−9	−1	−6	1	−5	3	−3	5	−2	6
Springfield	−15	−5	−13	−3	−8	0	−5	3	−3	5	−2	6	0	8
INDIANA														
Evansville	−7	1	−5	3	−1	6	2	10	4	12	6	14	7	15
Fort Wayne	−14	−2	−12	−1	−8	1	−6	3	−5	5	−3	6	−1	7
Indianapolis	−11	−2	−10	−1	−8	2	−4	5	−3	7	−1	8	0	10
IOWA														
Dubuque	−24	−11	−22	−10	−18	−8	−15	−5	−13	−3	−10	−2	−9	−1
Keokuk	−18	−8	−17	−7	−13	−3	−9	0	−7	2	−5	4	−4	5
Sioux City	−24	−16	−23	−15	−20	−11	−16	−8	−14	−6	−12	−3	−11	−3
KANSAS														
Concordia	−15	−6	−14	−5	−10	−2	−8	2	−5	3	−3	5	−2	6
Dodge City	−12	−3	−11	−2	−9	1	−6	5	−4	7	−1	9	0	10
Goodland	−17	−9	−16	−7	−14	−3	−10	1	−7	4	−6	6	−5	8
Wichita	−10	−1	−8	0	−6	3	−2	6	1	9	2	11	3	12
KENTUCKY														
Lexington	−8	1	−6	2	−4	5	0	8	2	10	4	13	6	15
LOUISIANA														
New Orleans	22	28	23	30	26	33	29	36	31	37	32	39	33	40
Shreveport	11	21	13	22	16	25	19	26	21	28	23	30	24	31
MAINE														
Eastport	−17	−10	−16	−7	−12	−4	−10	0	−7	1	−6	3	−5	4
Portland	−14	−5	−12	−3	−9	1	−6	3	−4	5	−2	6	−1	8
Van Buren	−42	−23	−41	−22	−37	−19	−34	−15	−32	−13	−30	−11	−28	−10
MARYLAND														
Baltimore	2	10	4	11	6	14	9	16	10	18	12	19	13	20
Cumberland	−6	6	−5	7	−2	10	1	12	4	14	5	15	6	17
MASSACHUSETTS														
Boston	−10	0	−7	2	−3	5	0	9	2	11	3	12	4	14
MICHIGAN														
Alpena	−18	−8	−17	−6	−13	−4	−10	−1	−9	1	−8	2	−7	3
Detroit	−10	−1	−9	0	−5	2	−3	5	−1	6	0	8	1	9
Grand Rapids	−11	−1	−10	0	−7	2	−2	5	−1	7	0	8	1	9
Marquette	−18	−10	−17	−9	−14	−6	−12	−4	−10	−2	−9	−1	−8	0
MINNESOTA														
Duluth	−33	−23	−32	−22	−29	−20	−26	−16	−25	−14	−23	−13	−22	−12
Minneapolis	−27	−19	−25	−18	−23	−15	−20	−12	−18	−10	−17	−8	−16	−7
Moorhead	−35	−25	−32	−24	−31	−22	−28	−18	−26	−16	−24	−15	−23	−14
MISSISSIPPI														
Vicksburg	11	20	13	22	16	24	20	27	21	29	23	31	24	32
MISSOURI														
St. Joseph	−16	−7	−15	−6	−12	−3	−9	0	−6	2	−4	4	−2	6
St. Louis	−10	−1	−8	1	−3	4	0	8	2	10	3	11	5	13
Springfield	−11	−1	−9	0	−5	4	−1	8	1	11	3	12	5	13
MONTANA														
Billings	−36	−23	−34	−22	−31	−19	−26	−14	−22	−11	−20	−9	−18	−7
Havre	−42	−31	−39	−29	−36	−26	−33	−23	−30	−20	−28	−17	−26	−15
Helena	−32	−25	−31	−24	−29	−21	−25	−17	−22	−13	−20	−11	−17	−8
Kalispell	−26	−16	−25	−16	−22	−13	−18	−10	−16	−7	−13	−5	−11	−3
NEBRASKA														
Lincoln	−20	−10	−18	−9	−16	−6	−13	−3	−10	−1	−9	0	−7	1
North Platte	−22	−12	−21	−10	−18	−8	−15	−4	−12	−2	−11	0	−10	1

STATE AND CITY	AVERAGE FREQUENCY OF RECURRENCE													
	Once in 3 Years		Once in 2 Years		Once per Year		Twice per Year		3 Times per Year		4 Times per Year		5 Times per Year	
	TEMPERATURES, F													
	Minimum	Mean	Minimum	Mean	Minimum	Mean	Minimum	Mean	Minimum	Mean	Minimum	Mean	Minimum	Mean
NEVADA														
Logandale	14	28	14	29	16	31	19	32	20	34	21	35	21	36
Reno	−10	5	−7	7	−3	9	0	13	2	15	5	17	7	18
Searchlight	14	22	15	23	17	25	20	28	22	30	23	31	24	32
Tonopah	−5	2	−4	4	2	9	4	11	7	13	8	14	9	15
Winnemucca	−15	−8	−24	−6	−19	−1	−13	4	−8	8	−6	10	−5	11
NEW HAMPSHIRE														
Concord	−20	−8	−18	−6	−16	−1	−12	1	−10	3	−8	5	−7	6
NEW JERSEY														
Atlantic City	0	9	1	10	4	13	7	16	9	18	11	19	12	20
NEW MEXICO														
Roswell	−4	9	−2	10	2	14	6	18	9	20	10	22	12	23
Santa Fe	−3	7	−2	9	0	11	2	13	4	15	5	16	6	17
NEW YORK														
Albany	−18	−9	−16	−7	−12	−2	−8	2	−6	4	−4	6	−3	7
Buffalo	−8	−3	−7	−1	−5	3	−2	5	−1	7	0	8	2	9
New York	−6	4	−3	6	0	10	4	12	6	14	7	15	8	17
NORTH CAROLINA														
Asheville	−2	9	−1	10	3	11	7	17	9	19	11	21	12	22
Raleigh	8	16	8	18	11	20	14	23	15	24	17	25	18	26
Wilmington	12	21	13	23	16	25	19	28	21	30	23	31	24	32
NORTH DAKOTA														
Bismarck	−39	−27	−37	−25	−33	−22	−29	−20	−27	−17	−26	−16	−25	−14
Devil's Lake	−40	−30	−38	−29	−35	−26	−32	−23	−30	−21	−28	−20	−27	−19
Williston	−39	−29	−37	−27	−34	−24	−31	−22	−29	−20	−27	−19	−26	−18
OHIO														
Cincinnati	−10	0	−9	1	−5	3	−2	6	0	9	2	11	3	12
Cleveland	−7	1	−6	2	−4	4	−1	7	0	8	2	9	3	10
Columbus	−9	0	−9	0	−7	3	−2	6	0	8	1	10	3	11
OKLAHOMA														
Oklahoma City	−4	4	−2	5	1	8	4	12	7	15	9	16	10	18
OREGON														
Baker	−21	−8	−19	−7	−15	−3	−11	1	−8	4	−5	6	−4	7
Medford	3	15	6	16	9	20	13	24	15	26	17	27	18	28
Portland	11	15	12	16	14	19	16	21	18	22	19	24	21	25
PENNSYLVANIA														
Philadelphia	1	9	2	10	4	12	8	15	10	17	11	18	12	19
Pittsburgh	−7	1	−6	2	−4	4	−1	7	1	9	3	11	5	12
Scranton	−9	0	−7	3	−5	5	−1	8	1	9	2	10	3	11
Somerset	−20	−4	−17	−3	−14	0	−10	3	−8	6	−6	8	−4	9
RHODE ISLAND														
Providence	−8	0	−6	2	−2	6	0	9	3	11	4	12	5	13
SOUTH CAROLINA														
Charleston	17	23	18	25	22	29	25	33	27	34	28	35	29	36
Columbia	12	21	13	22	16	26	19	28	21	30	22	31	24	32
SOUTH DAKOTA														
Huron	−31	−21	−29	−19	−26	−16	−23	−14	−22	−12	−20	−10	−18	−9
Rapid City	−28	−19	−27	−18	−24	−15	−21	−12	−18	−9	−17	−7	−15	−6
TENNESSEE														
Knoxville	2	9	3	11	6	14	9	19	12	21	14	23	15	24
Memphis	5	11	6	12	8	15	11	18	14	20	15	22	16	23
TEXAS														
Amarillo	−5	4	−4	5	−2	7	1	13	4	15	6	17	8	18
Brownsville	25	32	26	35	30	37	31	39	33	40	34	42	35	43
El Paso	14	25	16	25	18	27	19	30	21	32	22	33	23	34
Fort Worth	7	16	10	18	12	21	15	23	17	26	18	27	19	28
San Antonio	17	22	18	25	21	29	24	32	25	34	26	35	27	36
UTAH														
Modena	−23	−9	−22	−6	−17	−2	−13	2	−11	5	−9	6	−7	9
Salt Lake City	−8	1	−6	2	−2	7	3	12	5	14	7	15	8	16
VERMONT														
Burlington	−25	−17	−23	−13	−19	−8	−16	−6	−14	−3	−12	−2	−11	−1
VIRGINIA														
Lynchburg	0	13	2	14	4	15	8	18	9	20	11	22	13	23
Norfolk	9	16	10	17	13	20	16	22	17	24	19	26	20	27
Wytheville	−5	5	−4	6	−1	9	2	12	5	14	6	16	8	17
WASHINGTON														
Seattle	14	19	15	20	17	23	19	24	21	26	23	28	24	29
Spokane	−15	−3	−13	−2	−9	0	−7	2	−4	5	−1	7	1	9
Yakima	−14	−1	−11	1	−8	3	−4	5	0	7	1	10	3	11
WEST VIRGINIA														
Elkins	−14	0	−11	1	−8	3	−5	6	−3	8	−1	10	1	12
Parkersburg	−9	3	−7	4	−3	6	0	9	2	12	4	13	5	15
WISCONSIN														
Green Bay	−24	−13	−23	−12	−20	−10	−17	−8	−15	−6	−14	−4	−12	−3
LaCrosse	−27	−16	−26	−15	−24	−12	−21	−9	−18	−7	−16	−6	−15	−5
Milwaukee	−18	−10	−16	−9	−14	−5	−11	−3	−9	−1	−7	0	−6	2
WYOMING														
Encampment	−30	−12	−26	−11	−22	−6	−17	−1	−14	1	−12	4	−10	5
Lander	−36	−22	−34	−20	−27	−16	−23	−12	−21	−9	−19	−7	−18	−5
Sheridan	−35	−22	−33	−21	−29	−19	−25	−14	−23	−11	−21	−9	−19	−7
Yellowstone Park	−34	−24	−33	−22	−29	−18	−25	−13	−20	−9	−18	−6	−16	−4

times per year and a daily mean temperature of 26F or lower occurred on the average of three times per year.

The author points out that it is unsound practice to use the same design temperature for all types of buildings built in a given locality. For example, slight underheating for a few days each year can easily be tolerated in a residence but the same underheating in a hospital would be very undesirable. He further believes, based on his analysis, that in general design temperatures for the northern or colder sections may be selected for a higher frequency of recurrence than for the southern or warmer sections. He adds that this rule must be observed if the heating systems in all parts of the country are to be sized for approximately the same percentage of the maximum heating load. The following example is given to illustrate this point:

	Mobile, Ala.	Duluth, Minn.
Design temperature, selected as the mean temperature occurring once a year, Table 7	30F	—20F
Temperature difference for heat loss calculations: 70F —the design temperature.	40F	90F
Lowest mean temperature during the period studied, Table 3	23F	—28F
Difference between design temperature and lowest mean temperature	7F	8F
Overload on heating system on coldest day	17.5%	8.9%

In this tabulation the difference between the design temperature used and the minimum temperature on record is somewhat higher for the colder station. However, the percentage of overload that would have to be carried by the heating system on the coldest day is much higher for the warmer city. This could be corrected by selecting a design temperature which occurs less frequently for the warmer city.

The author includes in his bulletin a map, reproduced here in a redrawn form, to show zones of approximately equal weather severity. The lines plotted on the map indicate the daily mean temperatures which may be expected to occur with an average frequency of once a year.

The author's conclusions are:

1. The daily mean temperature is a better indication of heating load than the daily minimum temperature. It is therefore a more logical basis for the determination of design temperature.

2. The design temperature should be based upon the probable frequency of recurrence of low temperatures, rather than upon the lowest daily mean or daily minimum temperature on record.

3. There is no one frequency of recurrence which should be used for the selection of all design temperatures. It will depend upon the type of building or the purpose for which it is to be used, upon the severity of the weather in the district in which the building will be built, and upon local weather peculiarities.

4. Any attempt to predict weather conditions in one city from weather data for another city should be made with caution.

Year-Round Air Conditioning Available in 1940 Automobile

Cooling, or warming, filtering and dehumidifying of the air in automobile interiors, long wanted by motorists and long sought by engineers, has arrived as the very latest boon to motor car passengers. An automobile can now be heated with filtered air in winter, and on the hottest, most humid days of summer it can be as cool as the most modern air-conditioned home or other building. A car now also offers escape from dust and pollen laden air.

The Packard Motor Car Company announces that it has the first automobile mechanical refrigeration air cooling system, a unit which also filters the air in a car and provides heat in winter, now ready for the public. It is offered by Packard as a standard, factory installed, extra cost accessory.

Through use of the new device, air in an automobile body is cooled to the temperature desired by passengers, dehumidified, filtered and circulated through the car. A simple adjustment, easily made by a passenger, causes the system to circulate filtered warm air when desired.

Cooling is obtained by means of a refrigerating plant, according to W. M. Packer, vice president of distribution of the Packard Motor Car Company, explaining the new accessory.

The refrigerating coils are located back of the rear seat in an air duct with heating coils in another compartment of the same duct. An electrically-driven fan forces air through either set of coils at the will of the passengers, the filter operating as air travels through the duct. It has been found in tests that this filter removes practically all dust from the air in the car. It also so largely removes pollen as to be helpful to hay fever victims.

The treated air follows along the top of the car so that it does not blow directly on any of the passengers. It returns along the floor, passing under the rear seat to the coils for recooling, or reheating, and is then recirculated by the fan.

The compressor is mounted on top of the engine and is driven from the radiator cooling fan.

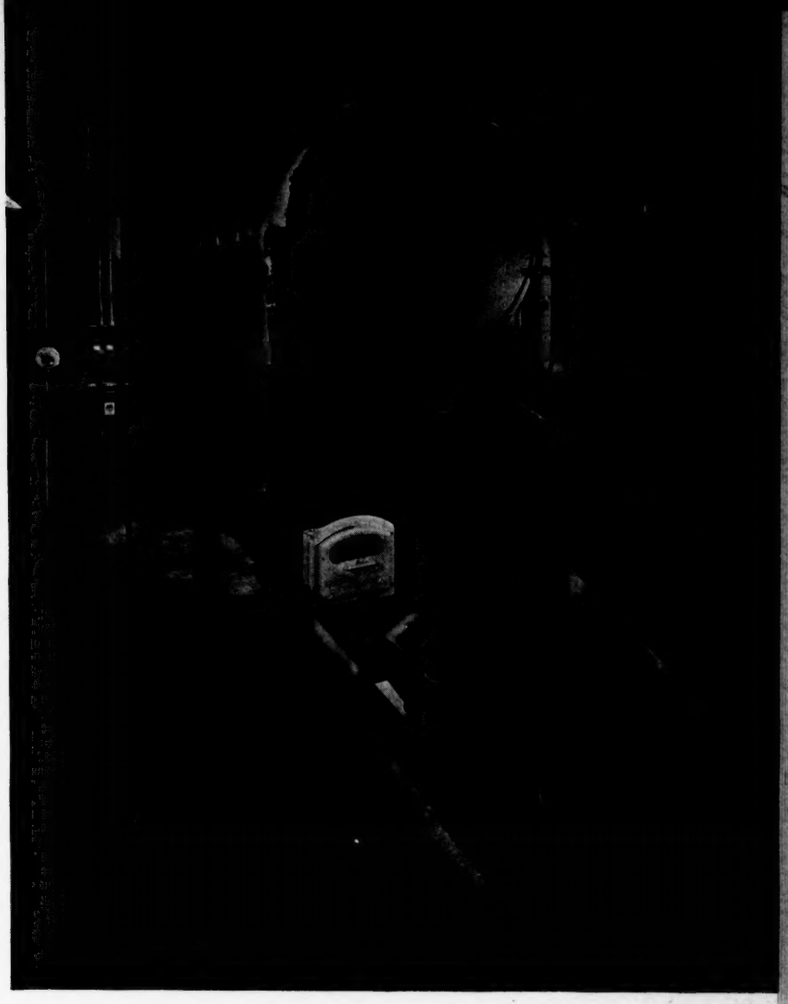
The cooling system has a cooling capacity of one and one-half tons at 60 miles an hour and two tons at 80 miles an hour.

Mr. Packer in making the announcement stated: "There has been much talk about giving automobiles the real cooling, filtering and dehumidifying of modern air conditioning systems. Development of a system for motor cars, however, was not finally accomplished without long and intensive engineering effort during which many problems were encountered and successfully solved."

Commercial Stokers for Anthracite

By RALPH A. KRAUSS†

Anthracite stokers of a capacity suitable for use in small commercial buildings should not be compared with those intended primarily for small residences. Both have developed more or less side by side but the recent concentrated attention directed toward the small residence stoker has tended to obscure what has been accomplished with commercial sizes. The author gives a brief survey of what has occurred recently in the development of commercial anthracite stokers. The paper was originally presented at the Second Anthracite Conference at Lehigh University in April, 1939



STOKER manufacturers in the commercial field, which embraces units having capacities between 100 and 1000 lb. of coal per hour, or 25 to 250 boiler horsepower, report increasing sales and are optimistic regarding the future.

Performance of Underfeed Stokers

These underfeed stokers are ordinarily fired with rice anthracite. Buckwheat anthracite may also be used with extremely good results. So far the use of barley has proven unsuccessful.

The outstanding characteristic of these stokers is the freedom from manual attention and resultant saving in labor costs. It is common practice for the hoppers to be filled and the ashes removed twice a day by unskilled labor, the firedoors not being opened for days or weeks at a time.

The burning capacity of stokers of this type is about 15 lb. per sq. ft. of grate area for the stationary grate types. This figure is increased to 20 lb. or more per sq. ft. when moving grates are used. The percentage of combustible in the ash depends very largely upon the coal feed rate and should not exceed 40% for the capacities given above. When running at partial loads, the combustible will be less. The CO_2 under steady running conditions is in the neighborhood of 10% on small stokers and in the case of the larger stokers observations indicate that 13% to 14% may be expected.

An outstanding feature of anthracite stokers of any type is the fact that in adequately sized boilers high settings (to obtain large combustion volumes) are unnecessary. This feature tends to reduce the installation cost as compared to oil burners or bituminous stokers which always require ample combustion volume.

†Combustion Engineer, Anthracite Industries Laboratory.

The stoker may therefore be set at floor level and when installed in a firebox type of boiler, little if any brickwork is necessary. The opinion was once held that dependable ignition could be secured only by the use of a certain amount of brickwork in the combustion chamber. Experiments, however, proved this to be entirely unnecessary as ignition and very satisfactory overall performance were obtained with the stoker set inside the water walls without any brickwork and using the hardest type of anthracite which could be obtained.

These characteristics combine to afford an extremely desirable piece of equipment for either heating or power loads in such locations as hotels, apartments, hospitals, greenhouses, laundries, office buildings and small industrial plants.

Commercial Chain Grate Stokers

Chain grate stokers are most certainly an efficient method of burning the small sizes of anthracite. Thousands of power plant installations bear witness to their efficiency, ruggedness and dependability. Unfortunately, however, this equipment has been considered generally impractical for burning capacities of less than 1000 lb. per hour. This is not only because of the cost of the installation itself, but because in boiler plants of this size there is seldom sufficient headroom for the refractory arches which have been considered necessary.

New Developments

One commercial chain grate stoker which was sold several years ago has recently been redesigned, using

a number of ingenious methods to reduce construction costs. The grate drive mechanism, for example, requires a speed reduction in the neighborhood of 30,000 to 1 for a small stoker and not much less than this for even a large one. Other designs commonly use a double worm reduction unit, the final worm gear in the train being quite large and expensive. The initial speed reduction of 60 to 1 is obtained by a single worm gear built into the motor, the remainder being obtained through the use of two ratchets in tandem. This construction is obviously very much cheaper and more rugged than a worm gear drive.

Perhaps the most interesting feature of this design is the means by which ignition is accomplished. The arrangement of the parts is shown in Fig. 2. By means of the inclined feed chute and the so-called leveling pipe, the incoming fuel is forced to travel in practically a vertical, downward direction as it enters the furnace. At this point, it meets a current of air from a windbox placed just beyond the end of the feed chute.

Once ignition has been established at the bottom of this zone, the incoming fuel is heated by the combustion of that which has immediately preceded it, and according to tests conducted by the Bureau of Mines, the ignition speed under such circumstances may be increased by increasing the air velocity, the only limit being when the fuel particles are blown out of the fuel bed. Needless to say, this construction eliminates the necessity for an ignition arch. The water-cooled leveling pipe is but a minor complication, although it must be connected to the boiler in such a manner that active circulation of the cooling water is obtained.

Grate Speed Control

By placing a temperature sensitive element such as a thermocouple in the ignition zone, means become available for controlling the speed of the grate accordingly. This is believed not only highly desirable, but really necessary for fool-proof operation, for if the speed of the grate exceeds the speed of ignition, the fire will be discharged into the ashpit, whereas if the ignition speed exceeds the grate speed, the fire will creep up into the hopper. A further advantage of this ignition

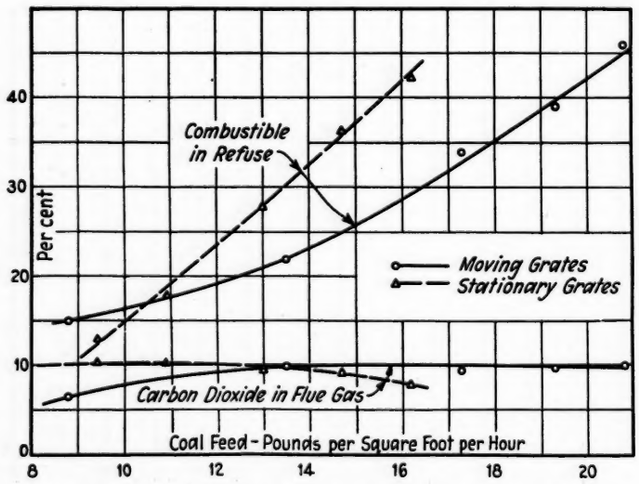


Fig. 1. Performance of a typical commercial underfeed stoker.

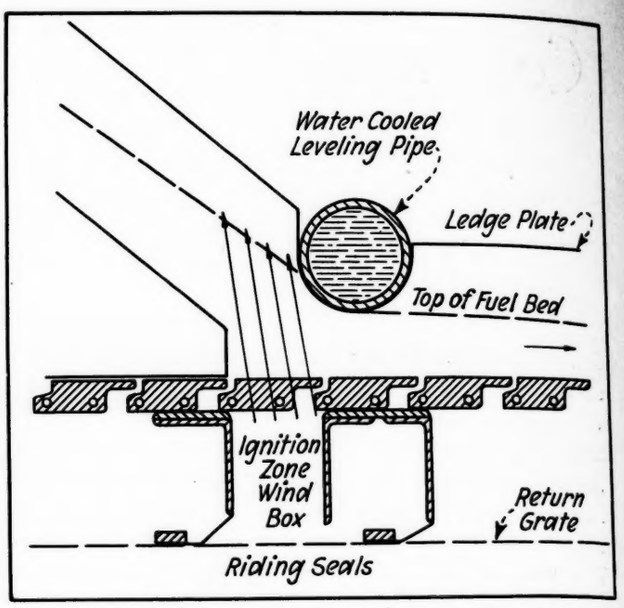


Fig. 2. Overfeed ignition on a chain grate stoker.

control is that it permits the grate to run at intervals when the fire is banked, maintaining the normal length of active but dormant fuel bed so that even after a shut-down over the week-end, extremely rapid acceleration is obtained.

Fuel Size

The present design of the grate links does not permit the use of anthracite smaller than rice. However, changes have been suggested which it is hoped will render the use of barley practical.

Probable Performance

At the present time, this stoker is in the development stage, but it is not considered too optimistic to predict combustion rates of 25 to 30 lb. per sq. ft. based on the total projected area required in the firebox. CO_2 of 12% or better is a reasonable expectation. In the absence of a rear arch, the fire at the tail end becomes extinguished by lack of heat rather than by lack of air, and the inherent combustible in the ash appears to be between 30% and 35%. Undoubtedly, the corresponding ashpit loss of 6% to 8% can be considerably diminished where conditions permit, by the use of a short rear arch. Thickening of the fuel bed by raising the leveling pipe is also a possible means of decreasing this loss but this will also entail the production of carbon-monoxide at the front end, complicating the problem.

Advantages

Providing this stoker can be developed into a practical commercial design, it will present certain advantages over the underfeed type. Because of its greater burning capacity per unit area, it can be made both smaller and lighter and therefore, probably somewhat less expensive in addition to the possibility of its being installed in boilers where the available firebox space is meager.

How to Reduce Sun Heat through Windows

By CLIFFORD STROCK

Sun heat transmitted through windows is frequently a large part of the summer air conditioning load in a building. This article shows how this load can be reduced by use of heat absorbing glass and by shading. Tables are included for the rapid calculation of load through either ordinary or special glass. The article is confined to single thicknesses of flat window glass.

OF the various heat gains which go to make up the summer air conditioning load in a given building, nothing much can usually be done about the internal heat load from the occupants and appliances. The heat transmitted through the walls from the outside, however, can be reduced by insulating the walls; the solar heat transmitted through the roof can be reduced by various methods as explained on these pages some months ago. It is the purpose of this article to point out to what extent another very important part of the air conditioning load—solar heat passing through windows—can be cut down by the use of special absorbing glass windows, to emphasize the importance of shading the windows, and to show how problems involving sun heat through windows can easily be solved.

Obviously the purpose of a window is to admit light. Since this light is energy it helps build up the heat load. To decrease the energy entering the room by cutting out the light would be no solution of the problem whatever. How, then, can the energy transmission of windows be reduced? To answer this it is necessary to have a fair understanding of solar energy and its properties.

Solar Energy

The energy given off by the sun is in the form of waves and covers a rather wide range of wave lengths from 0.292 to 5.3 microns (a micron is one ten-thousandth of a centimeter). This solar energy is made up of three types of waves—ultra-violet, visible light, and infra-red rays. The wave lengths from 0.29 to 0.45 microns are the ultra-violet, those from 0.45 to 0.70 are visible light, and those from 0.70 to 5.0 microns are infra-red rays. The greater part of the sun's energy is in the form of infra-red rays, these accounting for 51.1% of solar energy. This information is summarized briefly in Table 1.

TABLE 1—SOLAR ENERGY

Wave	Wave Length, Microns	Per Cent of Total Solar Energy
Ultra-Violet	.29 to 0.45	9.6
Visible Light	0.45 to 0.70	39.3
Infra-Red	0.70 to 5.0	51.1
Total.....	.....	100.0

Note: Measurements of sun energy and solar heat transmission are difficult and, due to many variables, figures resulting from tests do not always agree closely. The figures used in this article are based on tests of a typical heat absorbing glass, and are sufficiently accurate for most air conditioning calculations. Among the prominent companies making such heat absorbing glass are: Pittsburgh Plate Glass Co., Pittsburgh (Solex); Libby-Owens-Ford Glass Co., Toledo (Aklo); Mississippi Glass Co., New York (Coolite); and Pennsylvania Wire Glass Co., Philadelphia (Actinic).

All these waves have the property of passing through glass directly just as radio waves enter a building. However, the upper and lower limits of ordinary glass in transmitting these waves are about 0.29 microns and 4.5 microns. In other words, ordinary glass is transparent to practically all the visible light, the longer ultra-violet rays and the shorter infra-red rays; it is opaque to the short ultra-violet rays and the long infra-red rays. The problem of the glass manufacturers, then, was to find out how a glass could be made which would change appreciably these characteristics of glass so as to reduce the energy transmission.

Transmission of Glass

The people who make glass, like everyone else, have their troubles, and the solution of this solar heat gain problem was one of them. They hesitate to make a glass which will be opaque to the energy in the ultra-violet band, because investigations have shown that ultra-violet rays are beneficial to human beings; a deficiency in the reception of ultra-violet by human beings causes rickets, for example. Neither do they want to cut down the light band, for any reduction in visible light rays entering through the glass reduces the efficiency of the window as a window. The only waves left are the infra-red, and since these are heat rays, any change made in glass to reduce the amount of infra-red that will pass through will correspondingly prevent the sun's infra-red rays from entering in the winter time.

However, since the sun does not shine too large a proportion of the time in the winter anyway, and since the fuel burned in a heating plant in the winter is ordinarily cheaper than electric energy for operating an air conditioning system, the most desirable reduction is probably in the infra-red rays.

Ordinarily, glass directly transmits 89.5% of visible light, 79% of the ultra-violet rays, and 79.5% of the infra-red rays. Applying the factors shown in Table 1 against these percentages, we see that ordinary glass transmits 83.4% of the solar energy directly. If we use a figure of 300 B.t.u. per square foot per hour as

TABLE 2

SUN'S RADIANT HEAT

HEAT IN THE DIFFERENT BANDS AND DIRECT TRANSMISSION THROUGH GLASS ON THE BASIS OF A TOTAL EMISSION OF 300 B.T.U. PER SQ. FT. PER HR.

		B.t.u. per Sq. Ft. per Hr.
IN ULTRA-VIOLET		
In the Sun's Rays	OO	= 28.8
Through Ordinary Glass	OC	= 22.8
Through Heat-Absorbing Glass	O	= 17.1
IN VISIBLE LIGHT		
In the Sun's Rays	OOOOO OOO	= 117.9
Through Ordinary Glass	OOOOO OO	= 105.6
Through Heat-Absorbing Glass	OOOOO C	= 84.9
IN INFRA-RED		
In the Sun's Rays	OOOOO OOOOO	= 153.3
Through Ordinary Glass	OOOOO OOO	= 121.8
Through Heat-Absorbing Glass	OC	= 19.2

Each O represents 15 B.t.u. per sq. ft. per hr., each C a fraction of 15.

the maximum solar energy at noon in the summer, we find that 1 sq. ft. of glass would transmit approximately 250 B.t.u. of energy per hour directly into the room.

During recent years glass manufacturers have introduced heat-absorbing glass, in the manufacture of which they have introduced special chemicals which give the glass the property of cutting down the transmission of all of the wave lengths, but principally the infra-red rays. A typical heat absorbing glass will transmit 59.5% of the ultra-violet rays, 72% of the

TABLE 3

SUMMARY—SUN'S RADIANT HEAT

HEAT TOTALS FROM TABLE 1

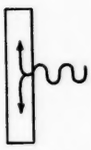
		B.t.u. per Sq. Ft. per Hr.
In the Sun's Rays	OOOOO OOOOO	= 300
Through Ordinary Glass	OOOOO OOOC	= 250.2
Through Heat-Absorbing Glass	OOOO	= 121.2

Each O represents 30 B.t.u. per sq. ft. per hr., each C a fraction of 30.

TABLE 4

SUNSHINE ON GLASS

A HEAT BALANCE, SHOWING WHAT HAPPENS TO 300 B.T.U. PER SQ. FT. PER HR. OF SOLAR ENERGY NORMAL TO A SINGLE PANE OF GLASS

		Ordinary Glass		Heat-Absorbing Glass	
REFLECTED		C	= 23.4	C	= 15.6
ABSORBED		C	= 26.4	OOOC	= 163.2
TRANSMITTED		OOOOO	= 250.2/300	OOC	= 121.2/300

Each O represents 50 B.t.u. per sq. ft. per hr., each C a fraction of 50.

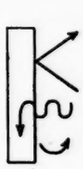
visible, and 12.5% of the infra-red, as compared with 79%, 89.5%, and 79.5%, respectively, for ordinary glass.

In order to illustrate the relative quantities involved, Table 2 has been prepared. This table shows only the solar energy which is *directly* (in the form of radiant waves) transmitted through the two kinds of glass. Table 2 was prepared on the basis that each square foot

TABLE 5

SUMMARY—SUNSHINE ON GLASS

A SECOND HEAT BALANCE ASSUMING THAT HALF THE ABSORBED HEAT ENTERS THE ROOM. AS IN TABLE 3, 300 B.T.U. PER HR. IS THE BASIS

		Ordinary Glass		Heat-Absorbing Glass	
KEPT OUT		C	= 36.6	OC	= 97.2
ENTERS		OOOOC	= 263.4/300	OOOC	= 202.8/300

Each O represents 60 B.t.u. per sq. ft. per hr., each C a fraction of 60.

TABLE 6

SUN HEAT TRANSMISSION OF SINGLE WINDOWS

Figures apply to midsummer conditions

PLAIN GLASS

B.T.U. TRANSMITTED INTO ROOM PER SQ. FT. OF GLASS PER HOUR

TIME OF DAY	ORDINARY VERTICAL GLASS WINDOWS FACING								HORIZONTAL SKYLIGHTS
	E	SE	S	SW	W	NW	N	NE	
6 AM	104	43					23	96	8
7	167	86					14	149	56
8	185	110						135	123
9	160	110						95	182
10	107	90	9					42	234
11	39	52	17						260
NOON		10	21	10					272
1 PM			16	51	39				256
2			8	87	104	40			226
3				106	154	91			175
4				107	178	130			119
5				86	167	150			56
6				43	104	98			8
6 AM	104	39					20	95	10
7	167	84					9	134	59
8	185	117						125	125
9	160	124	8					81	181
10	107	114	20						230
11	39	83	38						255
NOON		38	44	23					267
1 PM			38	68	39				251
2			22	103	104	28			221
3			7	120	155	78			174
4				118	178	120			118
5				91	167	134			59
6				45	104	95			10
6 AM	104	34					18	93	14
7	167	82					5	130	62
8	185	123						115	125
9	160	138	17					68	178
10	107	137	44					15	224
11	39	114	62						248
NOON		74	71	39					260
1 PM			61	86	39				244
2			42	119	104	14			216
3			16	131	155	65			172
4				125	178	110			118
5				97	167	130	5		82
6				47	104	93	18		14
6 AM	104	29					16	92	16
7	167	80						124	63
8	185	128	5					108	123
9	160	150	32					54	173
10	107	180	68					8	218
11	39	139	89	9					239
NOON		108	98	57					250
1 PM		9	87	105	39				235
2			64	135	104	6			210
3			31	145	155	52			166
4			5	135	178	100			117
5				102	167	124			63
6				48	104	92	16		16

HEAT ABSORBING GLASS

B.T.U. TRANSMITTED INTO ROOM PER SQ. FT. OF GLASS PER HOUR

TIME OF DAY	HEAT ABSORBING VERTICAL GLASS WINDOWS FACING								HORIZONTAL SKYLIGHTS
	E	SE	S	SW	W	NW	N	NE	
6 AM	80	33					18	74	6
7	129	66					11	115	43
8	143	85						104	95
9	123	85						73	140
10	82	69	7					32	160
11	30	40	13						200
NOON		6	16	8					210
1 PM			12	39	30				197
2			6	67	80	31			174
3				81	119	70			135
4				82	137	100			92
5				66	129	116			43
6				33	80	74			6
6 AM	80	30					15	73	8
7	129	65					7	103	45
8	143	90						96	96
9	123	95	6					62	139
10	82	88	15						177
11	30	64	29						196
NOON		29	34	18					206
1 PM			29	52	30				193
2			17	79	80	20			170
3			5	93	120	60			134
4				90	137	93			91
5				70	129	103			45
6				35	80	73			8
6 AM	80	26					14	72	11
7	129	63					4	100	48
8	143	95						89	96
9	123	107	13					52	137
10	82	108	34					12	173
11	30	88	48						191
NOON		57	55	30					200
1 PM			47	68	30				188
2			32	92	80	11			167
3			12	101	120	50			133
4				96	137	85			91
5				75	129	100	4		48
6				38	80	72	14		11
6 AM	80	22					12	71	12
7	129	62						98	48
8	143	99	4					81	95
9	123	116	25					42	133
10	82	123	51					5	168
11	30	107	69	7					184
NOON		83	75	44					193
1 PM		7	67	81	30				181
2			49	104	80	5			162
3			24	112	120	40			128
4			4	104	137	77			90
5				79	129	98			49
6				37	80	71	12		12

of surface receives 300 B.t.u. per square foot per hour from the sun, this being the maximum figure at noon in midsummer in the approximate latitude of New York and Chicago.

Table 2 can then be summarized, on the same basis, as shown in Table 3, bearing in mind that both Tables 2 and 3 relate only to the direct transmission and not to all of the heat entering the room.

When the sun's rays fall on any surface, part of them are reflected, and this reflection depends on the character of the surface and the material in question. The proportion of solar energy which is reflected by ordinary glass is 7.8%, but is only about 5.2% for heat-absorbing glass.

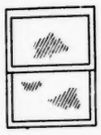
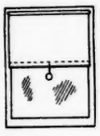
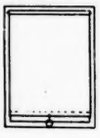
The total of the energy directly passing through glass and that reflected, does not, however, make up the total energy which is impinging on the surface, for some of the energy is absorbed in the glass itself. The amount of energy which is absorbed is equal to 100% less that which is directly transmitted and less that which is reflected.

The energy which is absorbed by the window glass

TABLE 7

EFFECT OF SHADING WINDOWS

RELATIVE QUANTITIES OF SOLAR HEAT IMPINGING ON UNSHADED AND VARIOUS TYPES OF SHADED WINDOWS

	UNSHADED WINDOW	OOOOO OOOOO = 100%
	SHADE, HALF DRAWN	OOOOO OC = 68%
	VENETIAN BLINDS (Slats at 45°)	OOOOO C = 58%
	SHADE, DRAWN	OOOOC = 45%
	CANVAS AWNING	OOO = 28%
	COATED AWNING (Aluminum)	OO = 22%

Source: ASHVE tests by Houghten

Each O represents 10% of the amount of heat entering an unshaded window, each C is a fraction of 10%.

is in the form of heat. This heat must flow somewhere, otherwise the glass would continue to build up in temperature. It is commonly assumed that this heat flows half to the inside surface of the glass and half to the outside, where it is picked up by convection and carried away by the air.

From the figures already given, then, we can determine the approximate quantities of heat (still on the basis of 300 B.t.u. per hour) which are reflected, absorbed, and transmitted by the two different types of glass. This information is shown in Table 4. On the basis that one-half of the absorbed heat goes to the inside of the surface—enters the room—and the other half returns to the outside air—namely, is kept out of the room—we can determine the amount of heat that is admitted into the room by use of heat-absorbing glass and ordinary glass. This is done graphically in Table 5. This shows that approximately 77% as much heat is admitted into the room when using heat-absorbing glass as when using ordinary glass.

All of the calculations shown so far were based on the idea of the sun's rays falling normal to the surface of the glass, which is something that rarely happens except in the case of skylights. However, for all practical purposes, we can assume that the relative figures are the same except that 300 B.t.u. applies only to rays normal (90°) to the surface. Reducing this angle between the rays and the window reduces the amount of heat which impinges on the surface, and this angle depends on the latitude of the city in which the building is located, whether the window is vertical, horizontal, or at some angle between, the direction of the compass which the window faces, the time of day, and the season of the year. Taking all of these into account, Table 6 has been prepared to show directly the amount of heat entering the room through ordinary single glass windows and through windows of heat-absorbing glass.

Solution of Problems

To use Table 6, determine the zone of the city where the installation is located by referring to the map, follow the arrow to the proper table, and opposite the time of day and under the direction faced by the window find the heat entering the room per square foot during the hour in question.

Example: What will be the summer heat gain at 3 p.m. through two windows 7 ft. x 5 ft., ordinary single glass, in the SW wall of a Washington, D. C., building, and how much heat would be saved by using heat-absorbing glass?

Solution: Refer to Table 6. The map shows that Washington lies in Zone 3. Follow the arrow to the tables indicated. Opposite 3 p.m. and under SW find 131 for ordinary glass (left hand table) and 101 for heat-absorbing glass (right hand table). These figures are per square foot, so that the transmission of the plain glass window during the hour from 2:30 to 3:30 p.m. is estimated at (7 x 5) x 131, or 4585 B.t.u.

The heat-absorbing glass transmission would be (7 x 5) x 101 = 3535 B.t.u. for the same hour. The saving would be 4585 — 3535 or 1050 B.t.u., for the hour.

In the case of skylights in this building, the loss would be 172 and 133 B.t.u. per square foot for the hour in question in Washington for plain and heat-absorbing glass, respectively.

Effect of Shading

All of the preceding information deals with unshaded windows. If there are shade trees outside the window the heat gain from the sun is sharply cut down, sometimes to the point where it becomes of little moment. In most cases, though, especially in cities, artificial shading must be relied on to reduce the solar energy impinging on the window. In a very valuable series of tests by the research laboratory of the ASHVE, the efficacy of various types of shading on windows was determined. This information is shown graphically in Table 7, with the results relative to an unshaded window. This graph shows, for example, that an ordinary canvas awning allows only 28% as much solar energy to pass through a window as falls on an unshaded window.

Although these tests applied to heat passing through ordinary windows, the figures given can be applied, for all practical purposes, against the figures in Table 6. That is, the figures in Table 7 can be multiplied by the factors in Table 6 to determine the heat transmission of plain or special glass with various methods of shading.

Example: What would be the heat gain in midsummer, through a 3 x 6 ft. single glass window at 4 p.m. in a Memphis building provided the window has Venetian blinds and faces the west?

Solution: Referring to Table 6, Memphis lies in Zone 2, and in the Zone 2 tables find, opposite 4 p.m. and under W, 178 for plain glass and 137 for heat-absorbing glass. In Table 7, the factor for Venetian blinds is 58%. Therefore, the heat transmission for that hour for an ordinary glass so shaded would be

$$(3 \times 6) \times 178 \times .58 = 1858 \text{ B.t.u.}$$

and for heat-absorbing glass

$$(3 \times 6) \times 137 \times .58 = 1430 \text{ B.t.u.}$$

In order to present the preceding information as conveniently as possible some of the information has been, perhaps, oversimplified. There are a number of points which should be kept in mind in considering the problem of sun heat passing through windows and among them are the following:

1. Tables 2 to 5, inclusive, were all prepared on the basis of a 300 B.t.u. per sq. ft. per hour energy emission. This is true only at the peak hour during the peak part of the summer as can be seen by reference to Table 6.

2. Table 6, it should be noted, covers only single thickness of glass such as is used in ordinary windows and does not apply to heavy plate glass windows. Neither does Table 6 apply to winter conditions.

3. The percentages given in Table 7 show that sharp savings are possible by the use of various methods of shading. It should be emphasized, however, that every one of these methods of shading involves an important reduction in the amount of light which can enter the room, so that the energy savings are made largely at the expense of light. This is not the case with heat-absorbing glass. Probably the ideal solution would be to use heat-absorbing glass, with shading provided for use during the peak hours.

ELECTRIC HEAT
for the Bathroom Floor

REGARDED as unusual, even in a model house with many innovations in equipment and surprises in furnishings and appliances, the electrically-heated bathroom floor in the Matchless Home, which is maintained by the Electrical Development League of Southern California at 3956 Wilshire Blvd., Los Angeles, is attracting wide attention among home owners and heating and electrical contractors.

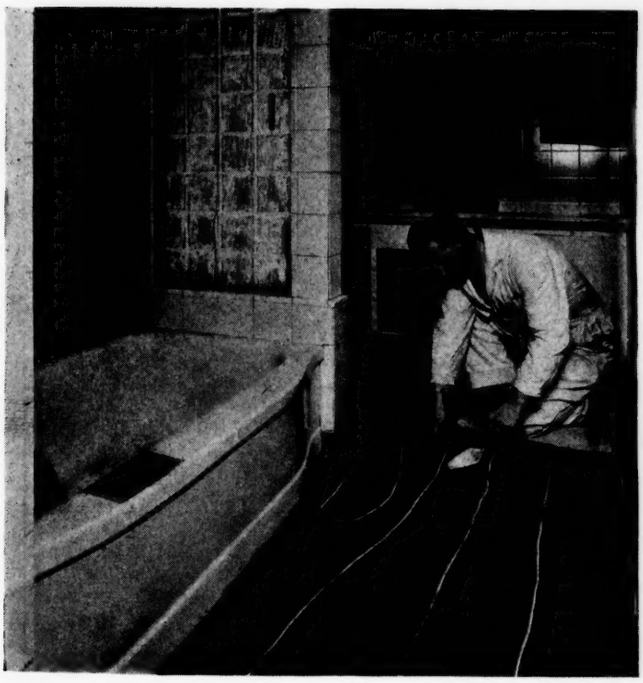
The Matchless Home, so-called because every appliance, machine and instrument it contains is electrically-operated, was built and equipped by the Development League as an exhibit at the Southern California Home Show this past summer. At the close of the show it was moved to its present outdoor location, where it is open to the public free every week day except Mondays.

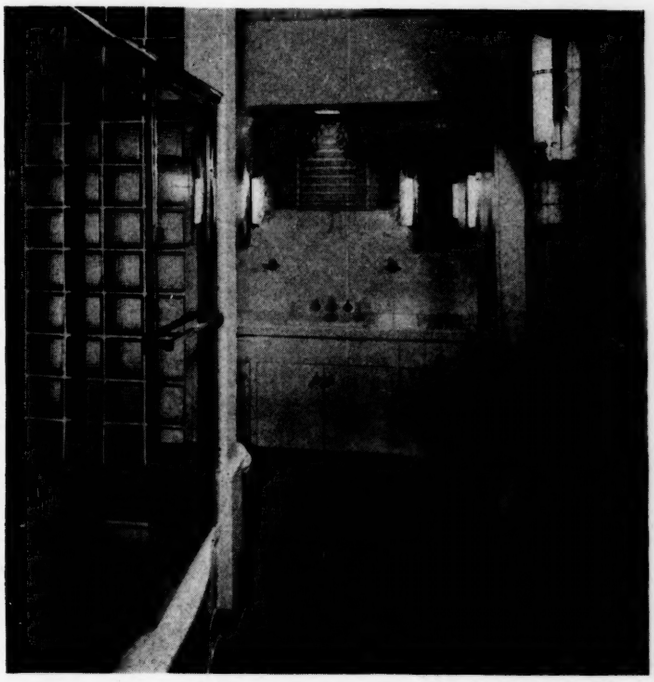
The idea for the heated bathroom floor was conceived by W. W. Pearce, industrial heating engineer for the Los Angeles Bureau of Power and Light, one of the several sponsors of the Electrical Development League. The floor-heating unit was installed in the house more or less in the nature of a novelty, but has effectively demonstrated its utilitarian value, according to F. L. Hockensmith, manager of the League.

The heating unit employed is of the soil-heating coil type. The unit involves 60 feet of one-half to one-eighth inch coil which is laid directly on the cement under the tiling of the bathroom floor, with a connecting wire running under the floor of the adjoining bedroom to the side of the bed. Dual control is provided: From a switch on the bathroom wall; and remote control from a wall switch beside the bed. The bathroom control is equipped with a pilot light to indicate whether the heat is on or off.

The heating unit operates on 110 voltage. Temperature, controlled by a thermostat, achieves a maximum of 80F. It takes about 20 minutes for the tile to reach 80F warmth, and less than five minutes to dispel the chill and make the tile fairly comfortable to walk upon in barefeet—one of the system's most attractive advantages, say its originators. The thermostat is effectively concealed in the rear of the lower right-hand drawer of the bathroom wash basin stand.

The chief purpose of the installation is comfort. While no widespread adoption of the idea has yet taken place, a number of installations have been arranged for in private homes in Los Angeles, Beverly Hills and Hollywood. Ultimately the floor-heating unit may develop into a substantial factor of business for heating and electrical contractors. A point in popularizing it undoubtedly may be the reasonable cost of its installation, for it can be installed quite cheaply, particularly in new homes where wiring and coils can be put in before the flooring and tile have been laid.





(Left) Arrangement of the heating coil, which is laid directly on the cement of the bathroom floor. (Right) The completed bathroom, with tile covering the heating coils. One control may be seen on the wall, above the towel rack. Another switch, for remote control, is installed on the wall of the adjoining bedroom. The second switch enables a person to turn on the heat while in bed, wait five or ten minutes, and walk into the bathroom on a comfortably warm floor.

EDITORIALS

Good Installation is Good Selling

Not long ago we had a letter from a man who is reported to be making a decided success of an engineering business in air conditioning and refrigeration in one of the country's largest cities. He has ideas about the value of good installations and about how important it is to the industry to keep up quality. He argues that customers of cooled restaurants or stores, patrons of the cooled theaters, and the travelers on the cooled railroad cars are all forming and expressing opinions about air conditioning generally as a result of their experiences. He put the point of his argument well when he wrote:

While the owner may be satisfied with his purchase and may pay for it knowing that he bought a cheap job, possibly inadequate, so that he could put the sign outside his building or in other ways attract trade, we as an industry suffer if that job is short of perfection. How can we tell how many executives or other persons influential in saying whether or not air conditioning should be used in their place of business, find reason to criticize this inferior installation and say, "I want none of it for myself"? This visitor does not know that the draft or the stale odor or the high humidity is due to pennywise purchasing policy, but jumps to the conclusion that the general idea itself is impractical or is in the experimental stage or is just plain no good.

This struck us as making good sense, for how can we tell?

No one has been in this industry long without hearing of the headaches which have come from bad installations. We don't hear so much about the repeat orders from good installations but they certainly do follow.

Feeling this way about the situation what could we do when our correspondent closed up his letter with the following?

I didn't mean to open up like this but if you and others who are in the editorial chairs could help us in some way to get this story across to all of the manufacturers, all of the dealers, and all of the engineers who are responsible for design in air conditioning work, we might find that the industry would progress much more rapidly if every job was a convincing salesman.

Again we agree, and we hope the story gets across.

◆

The Census

Once more the census year is at hand. In only another month the enumeration will be under way. The 1940 Census is to include not only a count of population, but the bi-ennial Census of Manufactures and a special census on Housing as well. To be most valuable the whole job must be completed as promptly as possible. That means getting the field work finished quickly, and the tabulating and publication just as soon thereafter as the gathering of the records will permit. The Census Bureau has worked out plans and schedules which are intended to help the work proceed rapidly. Public cooperation is necessary, however, and the Bureau asks that everyone furnish the required information cheerfully and promptly. In these days when there are so many questionnaires to be answered and so many returns to be made, it must be kept in mind that the Census is something which stands apart from all the other requests and demands for information. A good citizen can scarcely do less than cooperate both for what he can get from the results himself and for what the overall facts mean to the whole community.

◆

Basic Research is Well Sold

At the recent annual meeting of American Gas Association nothing commanded closer attention than a report recommending that a research program of modest proportion be started for the gas industry. It is also notable that the report clearly distinguished among standards, testing, product development and basic research, and suggested that the program under consideration be understood to be of basic character. No attempt was made to belittle or minimize the importance of drawing up standards, of conducting tests of existing products, or of developing new products but the report draws attention to the seldom emphasized fact that a program of basic research is different from all of these. It is a study of principles and of those abstractions from which no immediate and practical results are directly expected, but from which experience shows that the most startlingly practical results eventually may spring. Perhaps the most notable point about this statement is that it does succeed in drawing this distinction sharply.

Such a statement is also evidence of how times do change. It was not so long ago that a report of the kind submitted to the gas convention would have drawn nothing but laughs if read before a group of business executives. Such visionary proposals were left to the traditional visionaries such as scientists, university presidents, and the like. Now here is the head of a business organization actually proposing to the trade association convention of a great industry that the group go into something not immediately profitable. Research as a basic conception must have proved its case pretty well to permit such a turn of events.

ABSTRACTS of Current Papers, Books and Pamphlets

Principles of Exhaust Hood Design

This publication deals mainly with the design of exhaust hoods for use in eliminating industrial hazards causing occupational diseases. According to the author, much of the fundamental work discussed in this book was done at the Harvard School of Public Health almost ten years ago. A number of papers dealing with exhaust hoods which were prepared by the author and previously published are included and expanded in this publication. However, more than one-half the material included is new and hitherto unpublished.

From a practical standpoint only such examples of hood design as are considered outstanding by the author are included. While the hoods are designed principally for the control of industrial hazards, the basic principles of hood design which are discussed in this book are applicable to all types of conditions where local exhaust ventilation can be used.

The book is divided into nine parts, entitled as follows: Theory of Flow into an Opening; Velocity Characteristics of Common Types of Unobstructed Openings Experimentally Determined; Velocity Contours of Hoods with Special Boundary Conditions; Criteria for Determining Hood Effectiveness; Hoods for Dust Control; Hoods for the Control of Fumes, Mists, Vapors, and Gases; Grille-Type Openings Under Suction; Hood Entrance Losses, and Mathematical Theory of Velocity Contours and Stream Lines.

[*"Principles of Exhaust Hood Design" by J. M. Dalla-Valle. Published by U. S. Public Health Service, Washington, D. C. Paper cover; 8½ x 11 in.; 108 pages; mimeographed; copies distributed free as long as they are in print.*]

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Radiant Heating in Hospitals

The problem whether radiator, ceiling or floor heating is to be adopted in hospitals was discussed at the 6th International Hospital Congress in Toronto (September, 1939), and the following paper summarizes Swiss experience with this important problem.

The main requirements for hospital heating are the cleanliness of the heating unit, avoidance of air movements as far as possible (to avoid dust and bacteria transfer as well as to avoid draughts) and facilitating opening of windows by properly locating heating unit. All these requirements are fulfilled by the ceiling or floor radiation heating. The floor heating is, however, harmful to the feet and shoes, so that the ceiling heating seems to be the most desirable. The highest warm water temperature used for this heating is not above 125F. It has been stated that the specific fuel consumption in the case of ceiling heating is lower than in the case of other systems. This system seems to have also the advantage that it renders possible the accumulation in ceiling of great amounts of heat, so that the temperature is more constant in spite of the presence of large windows, especially in the operating room. In this latter room, ceiling radiation heating is specially desirable, as it eliminates any air movements and dust transfers. Besides, since in this room the patient is lying in the nude and in a horizontal position, it is very important to diminish the amount of heat he gives off towards the ceiling through radiation. Indeed the ceiling radiation heating seems to be the best solution for this problem. This is supported by the French statistics, showing that in a hospital with ceiling heating there was not a single case of postoperative pneumonia out of 650 operations. The ceiling heating can also be converted for the summer into ceiling cooling.

The author describes the practical experiences with this heating system in hospitals in Schwyz, in Bulach and in Konigsfelden (Switzerland). The improvement there has also been seen from the point of view of the patient's psychology, since it has been stated that his state of mind is better when he does not see the heating radiator.

The author gives the diagrams of temperatures as measured in the rooms with ceiling heating. This temperature is constant enough throughout the entire room, with abrupt increase at a distance of a few inches from ceiling and floor, and with abrupt decrease within close proximity to the window. The temperatures measured in equal distances from the floor are substantially equal.

The author suggests also a new solution for wall heating, namely, heating by means of electrically heated wall layers. He is of the opinion that such heating is technically possible, but good control instruments must be provided for it, as the heat capacity of such wall layers would be very small.

[*"Ceiling Radiation Heating in Hospitals" by P. E. Wirth in Gesundheits-Ingenieur, August 12, 1939, page 458. Published by Verlag R. Oldenbourg, Munchen 1, Brieffach 31, Germany. Price, 0.75 RM, approximately 30 cents. Abstracted by Dr. Stephen Zamenhof, M.E.*]

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Ventilation of Barns

The author investigated ventilation in cow-barns in Wieringermeer-Polder (Low Country); the results of this investigation are as follows:

The heat production of cows in cow-sheds amounts approximately to 49,600 B.t.u. in 24 hours.

The temperature of cow-sheds may be maintained and controlled by ventilating only from certain minimum outside temperature upward.

Identically built sheds may show great differences in regard to vapour condensation effects, because of: (a) different shed temperatures produced by ventilation and suction shafts, and (b) sheared or unsheared cow skin.

For every desired shed temperature, each shed construction has a certain critical outside temperature, corresponding to condensation effects in the shed. The

dew point is lower when the shed length and shed circumference per one cow is smaller, the walls are better insulated and the cows better sheared. These outlines together with economical considerations permit the calculation of rational insulation when building new cowsheds. Vapour condensation takes place in winter in the poorest insulated surfaces, and therefore these are to be avoided by homogeneous insulation as far as possible. The shafts extended over the roof are much better for ventilating purposes than the short chimneys, mainly because over the roof eddy winds are not so frequent. The shafts of sufficient height without control damper (flap), and opened or closed air passages seem to be sufficient to assure good ventilation control.

In the case of normally hairy cows the shed temperature is to be maintained 5 to 9F lower than in the case of sheared cows, in order to facilitate the heat escape to the former.

[*"Ventilation of Cow-Sheds" by L. L. Mulder in Gesundheits-Ingenieur, July 29, 1939, page 417. Published by Verlag R. Oldenbourg, Munchen 1, Brieffach 31, Germany. Price, single issues, 0.75 RM, approximately 30 cents. Abstracted by Dr. Stephen Zamenhof, M.E.*]

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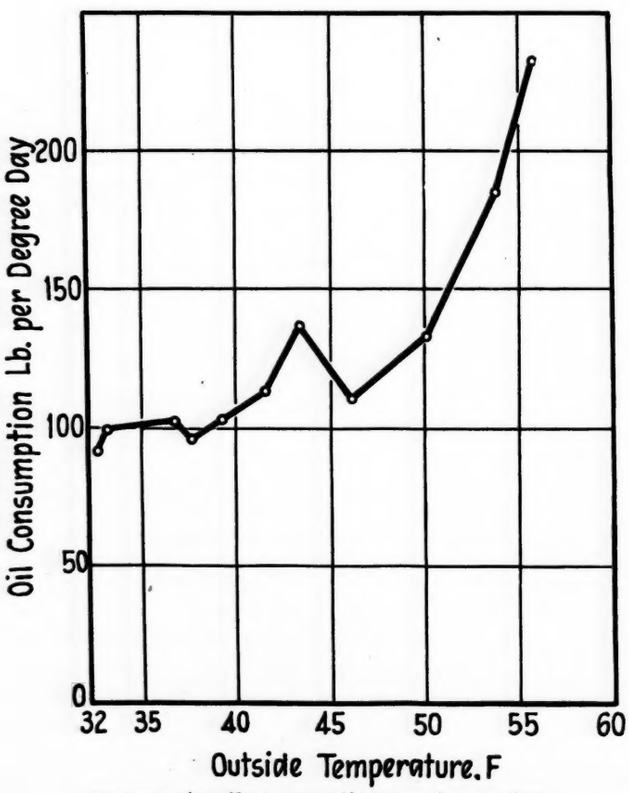
Degree Days

The majority of oil central heating plants seem to show a substantial increase in oil consumption per degree-day with increase of outside temperature. This increase is represented on the diagram.

Up to 46F, the increase is rather irregular, but above this temperature it is very pronounced. The reason for it may be seen in the following:

The circulation of water by thermosiphon starts at about 105F. If the outside temperature is so high that the water temperature of 105F is high enough, the circulation is poor and the efficiency of the boiler diminishes. The boiler then works not under the conditions of the optimal heat production, because it is too large for the purpose. Again the efficiency of the burner diminishes because it too becomes excessively large when the heat consumption decreases. Besides, when the temperature of the water (and combustion chamber) decreases, the combustion is more and more imperfect. The other reason for this increase in oil consumption is that when it becomes too hot the users open the window rather than turn down the radiator valves.

[*"Oil Central Heating Plants" by A. Minne in Revue des Combustibles Liquides, August-September, 1939, page 242. Published by La Revue des Combustibles Liquides, 3, Rue d'Aguesseau, Paris, France. Price, 15 fr., approximately 35 cents. Abstracted by Dr. Stephen Zamenhof, M.E.*]



Increase in oil consumption per degree day with outside temperature.

BRIEF REVIEWS

Carbon Bisulphide Vapor. This is the sixth of a series of leaflets describing methods for determining low concentrations of dangerous gases which may occur in the atmosphere in industrial works. It describes a method whereby concentrations of carbon bisulphide down to 1 part in 120,000 may be quickly estimated by drawing samples of the air through a bubbler containing a solution of suitable chemicals and comparing the color developed with a series of standard colors. [*"Carbon Bisulphide Vapor—Methods for the Detection of Toxic Gases in Industry." Leaflet No. 6. Published by the British Department of Scientific and Industrial Research and obtainable from the British Library of Information, 50 Rockefeller Plaza, New York. Paper binding; 8 pages; price, 10 cents.*]

Winter Temperatures. An analysis of winter temperatures for one hundred and twenty cities which was made to serve as a basis for the selection of heating design temperatures. For a more complete abstract of this paper see page 30 in this issue. [*"An Analysis of Winter Temperatures for One Hundred and Twenty Cities" by Clark M. Humphreys. Engineering bulletin 82, published by the Carnegie Institute of Technology, Pittsburgh, Pa. Paper cover; 6 x 9 in.; 36 pages; price, 50 cents.*]

Wrought Iron. A second edition of this book which has been written to serve as a source of up-to-date information for all who are interested in problems of material selection as well as for students in colleges and universities. Numerous photographs illustrate the various phases of the subject. Discusses history of wrought iron; present manufacturing processes; standards; characteristics; forging and bending; welding; principal applications and material selection. [*"Wrought Iron—Its Manufacture, Characteristics and Applications" by James Aston and Edward B. Story. Second edition. Published by A. M. Byers Company, Pittsburgh, Pa. Cloth bound; price, $1. Copies available on request to readers writing on their company letterhead.*]

NEWS OF THE MONTH

Contractor's Business Relationships Discussed by John Carter at First Fall Meeting of ASHVE Held in Atlanta

ATLANTA—The American Society of Heating and Ventilating Engineers held its first fall meeting here at the Atlanta-Biltmore Hotel, October 30-31. The meeting was held under the direction of L. F. Kent, general chairman, and in addition to the technical sessions included a get-together luncheon, sightseeing trips and a dinner-dance.

A paper on The Use of Air-Velocity Meters was presented by Professor G. L. Tuve, D. K. Wright, Jr., and L. J. Siegel. This paper was the result of research work on air-velocity instruments conducted at Case School of Applied Science. The report included a comparison of safe methods of instrument calibration and calibration curves for typical instruments. The authors concluded that, in considering the use of instruments other than the bridled-vane anemometer for measuring air velocities in open rooms, the following suggestions should be kept in mind:

1. Where directional effects are important, use a mechanical-type instrument.

2. Where comfort effects are important, and ample time is available, use a heated-type instrument.

3. For relative measurements, adhere to a single instrument, selecting one that will cover the entire velocity range.

4. For absolute measurements (i.e., those in which an accurate result in feet per minute is required), check the measurements by using more than one type of instrument.

5. Always take the average of several readings to represent the final result.

Burton E. Shaw, research chief, and LaVerne Lyon, research engineer, both of Penn Electric Switch Co., presented a paper on A Study of Certain Factors That Affect the Droop Characteristics of Thermostats, droop being defined as the peculiarity of a thermostat to control the temperature adjacent to its location at a point below the dial setting under certain conditions. The authors concluded that:

1. From the standpoint of thermostat design, droop is caused primarily by slow infiltration or drift of air into the thermostat and thermal inertia of the bimental and thermostat mass.

2. Some droop is caused by the use of artificial heat in a thermostat because of heat retention or carry-over through the off period after moderately long on periods.

3. The effect of cold walls on droop is opposite to that of the factors of thermostat lag and artificial heat. As the weather becomes colder and the wall temperatures decrease the thermostat influenced by such cold walls tends to operate at higher temperatures. Thus the effect of cold walls is to partly offset the droop of a thermostat.

4. Artificial heat in thermostats tends to decrease the morning over-run after a setback of temperature at night caused by cold walls, and air drift lag of the thermostat.

5. Tests data not yet completed indicate all types of artificially heated thermostats regardless of design or circuit method apparently will function to give the same general characteristics. With one type, however, the results were negative due to improper design and faulty performance.

Food Preservation in the South was the subject discussed by C. T. Baker, consulting engineer of Atlanta, who outlined the methods employed in preserving food commodities in the South and indicated the possibilities for further development in this field by the application of modern refrigeration.

The Application of Storage Refrigeration to Air Conditioning was described by Carl F. Boester, air conditioning engineer of St. Louis, who reported that savings when employing the storage principle average about 25 to 30%.

The results of research sponsored by the ASHVE and the Graduate School of the University of Minnesota, in cooperation with the Engineering Experiment Station of the University of Minnesota, were reported in a paper entitled "A Standard Air Filter Test Dust" presented by Professor F. B. Rowley and R. C. Jordan, both of the University. They concluded that carbon black and Pocahontas ash satisfy the requirements of a standard test dust if controlled within reasonable limits as to density and rate of burning.

John H. Carter, special representative of Frick Co., talked on An Analysis of the Air Conditioning Contractor's Business Relationships limiting his paper to the contractor's external relationships with customers and suppliers. Included in the points discussed by Mr. Carter were the contractor's relations with customers; the role of the consulting engineer; government contracts; contractor's relations with equipment suppliers; the contractor-distributor's franchise obligations; the benefits of such a franchise; direct sales by manufacturers and relations with competing contractors.

Agriculture Has Engineering Problems in Heating and Ventilating according to Frank B. Lanham, research agricultural engineer of the University of Georgia, who presented a paper so titled. Mr. Lanham discussed rural housing and the heating problems connected with such housing; sweet potato curing and storing; dairy production; hay production; and freezer locker systems for the farm. He reported that after curing, sweet potatoes can be kept almost indefinitely at a temperature of 50 to 55F and a relative humidity of 75 to 85%. Along these lines he presented information on the electric heating of a house for storing sweet potatoes.

Mr. Lanham reported that the moisture production of an average dairy is 12 to 18 lb. per day or an average of 4375 grains per hr. and that the amount of air provided in the majority of such systems in the South is about 59 c.f.m. per cow, although the amount of air breathed is only 1.9 c.f.m. per cow. He said further that at a stable temperature of 45F the humidity should not exceed 85%.

Lester S. O'Bannon, research engineer at the Kentucky Agricultural Experiment Station, described the recently completed air conditioning laboratory at the Kentucky Agricultural Experiment Station for research in the curing of tobacco. The laboratory was designed for experiments with air-cured tobacco and the chief objective was the determination of the conditions required for obtaining cured tobacco of the best quality.

Paul D. Close, of the Insulation Board Institute, presented a paper dealing with Permissible Relative Humidities in Humidified Buildings. Mr. Close pointed out that increased use of winter air conditioning involving humidification of buildings has introduced two types of condensation problems: (1) condensation within the insulating and building materials and (2) surface condensation. The first of these has been investigated by the U. S. Forest Products Laboratory at Madison, Wis., and by the University of Minnesota and others, while Mr. Close's paper dealt with the second problem. He presented a chart indicating conditions under which condensation will take place in buildings and which should be useful in the solution of condensation problems.

Movie, "Flow," Shown at Cambridge

CAMBRIDGE, MASS. — At the regular meeting of Massachusetts chapter of the ASHVE, December 19, at the Walker Memorial Building, M.I.T., there were two features. The first was a moving picture film entitled "Flow," by the Crane Company, showing how man has gained control over flowing liquids and gases. The second feature was a paper on the Precipitron.

Eastern Air Conditioning Conference Draws Three Hundred; ASRE and ACMA Among Sponsors of Lehigh Meeting

BETHLEHEM, PA.—Between 250 and 300 air conditioning and heating men attended the Eastern Air Conditioning Conference held at Lehigh University here November 10-11. The conference was sponsored by The American Society of Refrigerating Engineers, Air Conditioning Manufacturers Association, and the Philadelphia chapter of the American Society of Heating and Ventilating Engineers. Technical sessions were held in the morning and afternoon of November 10 and the morning of November 11. A banquet and get-together, at which Professor Philip Drinker spoke on the Air We Breathe, was held on the evening of the 10th.

Refrigeration Storage for Handling Peak Loads was the subject of a paper presented by Carl F. Boester, consulting engineer, St. Louis, who dealt primarily with the accumulation of ice in order to store refrigeration.

John Hertzler, general representative of the York Ice Machinery Corporation, was the author of a paper on Hotel Guest Room Air Conditioning. He classified hotel conditioning systems as of 5 types. For purposes of analysis he selected 8 installations, with a total of 1515 air conditioning guest rooms, and summarized the data from these installations on a unit basis. The floor area in square feet per person in these installations ranged from 102 to 198.6, while the average lighting wattage per square foot of floor space ranged from .363 to .816. Minimum outside air in c.f.m. per person ranged from 20.6 to 40, and the volume of circulated air per square foot of floor area ranged from .615 to 1.4. The floor area in square feet per ton of refrigeration covered a range of 295 to 605.

Lack of time prevented S. R. Lewis, consulting engineer, Chicago, from presenting his paper Complete Air Conditioning In an Educational Building in full, so that Mr. Lewis spoke briefly about his subject. He pointed out that there have been very few year-round air conditioning installations in schools due to the fact that most public grade and high schools are shut down during the summer so that cooling has received very little attention for these buildings. However, many colleges and private schools are open the year round and year round air conditioning is justified in these cases. Mr. Lewis' paper included rather extended comments on year round air conditioning in several schools he designed.

Air as a Vehicle of Contagion was the subject of a paper by Dr. W. F. Wells, Director of Laboratory of Air-Borne Infection, University of Pennsylvania School of Medicine. Dr. Wells brought out the importance of preventing the transfer of infection.

The Realistic Approach to Hospital Air Conditioning was the subject of a paper by Charles F. Neergaard, hospital consultant, New York, who said that hospital installations should be considered from five different angles and interests, as follows: those of the public health expert, the clinician or surgeon, the research engineer, the consulting engineer, and the operating engineer.

Dr. M. B. Ferderber, University of Pittsburgh, spoke on the Uses of Air Conditioning in Hospitals. Dr. Ferderber in his remarks said:

"In the past several years fever therapy has been used in the treatment of certain diseases which respond to a specified elevation of body temperature either to kill the offending organisms or to stimulate body resistance. The development of suitable devices to raise body temperatures was a natural outgrowth of the knowledge of air conditioning principles and the vagaries of heat loss or gain. A saturated environment which prevents heat loss and permits a lower dry bulb temperature has proved a safe, efficient, and simple procedure. Another development in this field has been the application of heating a local portion of the body by production of saturation, thus eliminating electrodes, cables, etc. This recent finding, it is hoped, will be a valuable adjunct in the treatment of peripheral vascular diseases besides those conditions for which heat has been advocated in the past.

"The production of ozone and heat in x-ray and physical therapy departments offers an additional field for air conditioning. This subject is now under investigation and needs further study. A new and yet unexplored field may be found in the treatment of contagious diseases in isolated wards. The fear of disseminating contagion and the crossing of the many infections present constitutes a barrier which is not insurmountable but which offers many difficulties which need solution.

"The broad field of hospital air conditioning offers many opportunities for further advances in air conditioning in the treatment of disease."

At the morning session of November 11, L. L. Lewis, vice-president, Carrier Corporation, presented an extended paper on the Moisture Removal from Blast Furnace Air in which he reviewed the work that has been done in providing dry blast for furnaces, discussed the economics of such installations, and described an installation recently made at the plant of the Woodward Iron Works, where a 535-ton cooling installation is used to dry the air supplied to one of the blast furnaces.

J. C. Albright of The Marley Company, presented a paper on Climate and Air Conditioning Design in which he discussed the interrelation of dry bulb, wet bulb, and dewpoint temperatures. Mr. Albright concluded that (1) the maximum daily temperature is attained as a rule for only a short time daily; (2) Either the average or the maximum temperature is a poor basis upon which to build a judgment of a proper design value; (3) Seasonal and daily ranges vary through wide limits in different locations; (4) Wide variations in one factor may be accompanied by a relatively small one in another; (5) The maximum values of the three temperatures do not occur simultaneously, and (6) Extreme dry bulb temperatures do not occur simultaneously with either maximum dew point or wet bulb temperatures.

Creating a Demand for Air Conditioning was discussed by J. L. Rosenmiller, chairman of the advertising and public relations subcommittee, Air Conditioning Manufacturers' Association, who reported that a survey of utility executives indicated that the principal objections to air conditioning were high cost, lack of customer education, and improper installations. In the opinion of the same executives, the most promising solutions of the problem are more customer education and lower priced equipment.

Mr. Rosenmiller stated that a study of methods used by various firms in the industry and their advertising show that the following results may be expected from air conditioning in commercial applications: (1) Increased sales volume, (2) improved employe health and efficiency, (3) reduction in merchandise spoilage, (4) new customers, (5) customers less irritable and easier to serve, (6) customers stay longer and buy more, (7) increased profits.

In the industrial field, the following reasons for buying air conditioning are emphasized: (1) Improved quality of product, (2) lower manufacturing cost, (3) protection of inventories, (4) improved employe health and efficiency, (5) workers are more satisfied—hence, a lower labor turnover.

In the residential market, the sales appeal is based on: (1) Year 'round comfort, (2) better health, (3) greater convenience, (4) cleaner homes.

Modified Atmospheres for Fruits and Vegetables in Storage and in Transit, were described by Charles Brooks, principal pathologist, Division of Fruit and Vegetable Crops and Diseases, Bureau of Plant Industry, U. S. Department of Agriculture.

Refrigerating Men Hear Papers on A.C., Fruit Storage, Breweries, at 30th Convention Held in Los Angeles

LOS ANGELES — Discussion dealing with practical methods and experimental progress in beer cellar cooling in breweries, precooling and conditioning of refrigerator cars used in transporting perishable products, and a comprehensive program of other refrigeration problems involving past, present and future practices of air conditioning, held a prominent spot on the program of the 30th annual convention of the National Association of Practical Refrigerating Engineers here November 14-17.

Attended by about five hundred refrigerating and air conditioning engineers and others, the meeting was notable for the comprehensive list of technical papers presented.

Some interesting phases of cooling and air control in brewing plants were brought out in an address, Operating Methods in Brewery Refrigerating Plants, by M. E. Bell, of the Los Angeles Brewing Co.

Prefacing his talk with the statement that practically all refrigerating requirements in a large brewery are at cooling temperatures, Mr. Bell outlined some variations of air conditioning practices that are applied successfully in various brewery operations. According to the speaker, considerable trouble had been experienced in the brewery he represented with wooden tanks drying out, bands loosening, and tanks leaking when forced-air cooling units were used in the cellar. It had been found impossible, he declared, to create an even distribution of air throughout the cellar, and the tanks nearest the outlet of the cooling units invariably dried out quickest. This difficulty was eliminated by employing small air-injection hydrating nozzles to inject a miniature fog at the outlet of the unit into the air stream. This method corrected the trouble, he declared, but urged the exercising of caution in its application so as not to create a wet or slimy condition of the floors.

The speaker stated that the majority of breweries now use direct-expansion systems for cellar cooling—the older plants utilizing wall and ceiling coils, and the more modern ones forced-air unit coolers. In his discussion of the relative values of various cooling systems, he declared the disadvantages of direct-expansion systems may be overcome by the use of brine, while, in most cases, the old ammonia coils may be converted for use as brine coils. Greatest difficulty found with direct-expansion systems, in his opinion, is the danger of liquid ammonia returning to the compressor, especially if the coils are permitted to become heavily frosted, and in warm weather when they are being forced to their full capacity. The brine system of cooling beer cellars, Mr. Bell asserted, overcomes most of the difficulties encountered with direct-expansion. He stated it was only theoretically true that the brine system is less efficient because lower suction pressure must be maintained. It has been found, he said, that the average annual suction pressure of an efficient brine cooler system will be as high and much more constant than that of direct expansion, for, with automatic liquid level and suction pressure controls, the maximum evaporator pressure can be maintained at all times, which is not the case, he said, with the direct expansion system.

In a paper on The Psychrometric Chart, J. C. Blair, instructor at the Frank Wiggins Trade School, Los Angeles, confined himself to outlining the invaluable short-cuts refrigerating and air conditioning engineers can make for themselves by the proper preparation and use of a psychrometric chart. Mr. Blair illustrated his lecture with a 10- by 20-foot psychrometric chart.

One of the activities at the convention was a round table discussion, participated in by four authorities on various phases of air conditioning, air cooling methods, preservation, and packing house problems. Those engaging in the discussion were William J. Finnigan, Los Angeles consulting engineer, who compared old and new cooling methods and air conditioning practices; D. G. Sorber, associate chemist, Laboratory of Fruit and Vegetable Chemistry, U. S. Department of Agriculture, who handled the subject of preservation from the standpoint of proper cooling and conditioning enroute from the field to the packing plant; Nels H. Rosberg, production manager, California Consumers Corp., Pasadena, who explained cooling, conditioning, freezing, packing and shipping problems that arise when the product has reached the packing plant; and R. L. Perry, assistant professor of agricultural engineering, University of California, who discussed various experiments being currently conducted for improving existing methods to make possible rapid freezing without unusually low temperatures.

New officers elected were: president, K. M. Holaday, St. Louis; first vice-president, H. T. Holbrook, San Francisco; second vice-president, J. J. Bryner, New Orleans; treasurer, E. T. Quinn, Los Angeles; secretary, Emerson Brandt, Chicago; sergeant-at-arms, Leland Kenargy, Newton, Kan.

Directors for 1940 will be Thomas Clark, V. Harrison, H. Petersson, B. C. White and W. E. Bernd.

Management Group Hears Papers on Air Conditioning in Industry

CHICAGO—The part air conditioning has played in stepping up production rates in industry, and leveling out the weather variations which plague manufacturers of materials sensitive to temperature and humidity, was described at the Production Conference of the American Management Association held here November 15-16. The speaker was W. B. Henderson, executive vice-president of the Air Conditioning Manufacturers' Association.

"Today there are over 2000 industrial air conditioning installations in manufacturing plants throughout the country," Mr. Henderson said, "resulting in improved quality of product, lower manufacturing cost, protection of inventories, and improved health and efficiency of employees."

As an example, Mr. Henderson cited the textile industry which, before the age of air conditioning, began in New England because the natural climate there was the best in the country for spinning and weaving operations. Now rendered almost completely independent of the weather, through the development of air conditioning, most of the textile plants have moved Southward, where they are close to sources of raw materials.

Another large user of air conditioning is the food industry, whose varied processes require temperatures ranging from zero to 80F, and relative humidities from 35 to 85%. In these applications, air conditioning has raised the quality of such foods as bakery goods, fruits, meats, milk, candy, flour, and vegetables.

Mr. Henderson also told how air conditioning is being adopted by machinery manufacturers to reduce the loss, by rejections, of accurately fitting steel parts whose size varies with the temperature. In these cases, the elimination of dirt from precision manufacturing processes has also been an important factor, in some cases resulting in direct savings which paid for the air conditioning in less than a month.

Other speakers at the conference included F. C. Houghten, director of the research laboratory, ASHVE, who spoke on "How Do Atmospheric Conditions Affect Employee Efficiency"; G. F. Begoon, Westinghouse Electric & Manufacturing Co., who discussed "New Developments in Solving Industry's Problems of Dust and Air Pollution," and A. E. Stacey, Buensod-Stacey Air-Conditioning, Inc., who spoke on the engineering fundamentals of heating, ventilating and air conditioning.

In addition to discussions on heating, ventilating, and air conditioning, the conference covered lighting, plant engineering and the effect of building design on production efficiency.

Government Enumerates Punishable Acts of Labor Unions; Arnold Lists Five Types of "Unreasonable Restraint"

WASHINGTON—Labor union practices which have "no reasonable connection with such legitimate objectives as wages, hours, safety, health, undue speeding up or the right of collective bargaining" are punishable under the anti-trust laws, Thurman Arnold, Assistant Attorney General, asserted in a letter to the secretary of the Central Labor Union of Indianapolis which the Department of Justice made public November 19.

Mr. Arnold outlined five types of union activity which he classified as "unquestionable violations of the Sherman Act." Prosecutions which are now proceeding or which may be undertaken, he stated, will be based on such violations, and "unions stand to gain" by the government's efforts to "prevent the use of legal rights of an association in an illegal way."

To illustrate the kind of activities which the government considered illegal, Mr. Arnold, in his letter, singled out the building trades unions, saying that it would be a violation of the anti-trust laws if such a union deliberately prevented the use of economical building material "in order to compel persons in need of low-cost housing to hire unnecessary labor."

For some months the Department of Justice has been investigating all branches of the building industry with a view toward uncovering any violations of the Sherman Act. This inquiry has embraced builders, contractors, manufacturers of materials and supplies and labor unions.

According to Mr. Arnold, the types of unreasonable restraint against which proceedings have been or will be begun illustrate concretely the practices which in his opinion are unquestionable violations of the Sherman Act, supported by no responsible judicial authority whatever. Mr. Arnold enumerated the five types of "unreasonable restraint" as follows:

1. Unreasonable restraints designed to prevent the use of cheaper material, improved equipment or more efficient methods. An example is the effort to prevent the installation of factory-glazed windows or factory-painted kitchen cabinets.

2. Unreasonable restraints designed to compel the hiring of useless and unnecessary labor. An example is the requirement that on each truck entering a city there be a member of the local teamsters' union in addition to the driver who is already on the truck. Such unreasonable restraints must be distinguished from reasonable requirements that a minimum amount of labor be hired in the interests of safety and health.

3. Unreasonable restraints designed to enforce systems of graft and extortion. When a racketeer, masquerading as a labor leader, interferes with the commerce of those who will not pay him to leave them alone, the practice is obviously unlawful.

4. Unreasonable restraints designed to enforce illegally fixed prices. An example of this activity is found in the Chicago milk case, where a labor union is charged with combining with distributors and producers to prevent milk being brought into Chicago by persons who refuse to maintain illegal and fixed prices.

5. Unreasonable restraints designed to destroy an established and legitimate system of collective bargaining. Jurisdictional strikes have been condemned by the A. F. of L. itself. Their purpose is to make war on another union by attacking employers who deal with that union. There is no way the victim of such an attack may avoid it except by exposing himself to the same attack by the other union.

Restraints of trade for such a purpose are unreasonable whether undertaken by a union or by an employer restraining trade or by a combination of an employer and a union, because they represent an effort to destroy the collective bargaining relationships of a union with an employer, according to the Assistant Attorney General.

Average Cost of Houses Dropping

WASHINGTON — The average cost of all non-farm homes constructed in the United States in the first six months of 1939 was $3611, representing a reduction of more than 10% in three years — brought about chiefly by increased willingness of families to buy dwellings of smaller size and simpler design and greater effort of the building industry in meeting mass demand. This observation is a high spot in 1939 fiscal year report of the Federal Home Loan Bank Board.

As the volume of public housing was comparatively small, the drop emphasizes primarily attempts of private industry to provide less expensive homes. Based upon building permit data reported to the Department of Labor, the decrease in average costs by types of dwellings is shown in the following table:

YEAR	ONE-FAMILY	MULTI-FAMILY
1936	$4,363	$3,639
1937	4,307	3,524
1938	3,971	3,224
1939 (to June 1)..	3,961	3,194

86% of A.C. Users Find It Pays, Weisenbach Tells Council

BUFFALO—Frederick A. Weisenbach, regional manager of the York Ice Machine Company, discussed Efficiency Through Air Conditioning at the monthly meeting of the Air Conditioning Council of Western New York November 15. Among the prominent guests and members were Health Commissioner Francis E. Fronczak; Clarence Gifford, vice-president of the Western New York chapter of the ASHVE; Moir P. Tanner, superintendent of the Children's Hospital, and Morton Wolfe, president of the Western New York chapter of the American Institute of Architects.

Health Commissioner Fronczak declared that he is recommending to the city administration that every new building be equipped with air conditioning and that he is making every effort to have more air conditioned structures in Buffalo because of the health benefits.

Mr. Weisenbach opened his address by declaring that air conditioning has stood a lot of abuse and that up until a few years ago the term was used arbitrarily to apply to most anything.

"Through the efforts of the manufacturing association we now have eliminated some of these abuses. It rests with men like you to see that air conditioning does mean something," he declared. Mr. Weisenbach said today many people feel that the name of air conditioning is not a very effective one for the industry. "But it would seem advisable to continue this name in order to avoid confusion that might arise from adopting another name," he added.

The speaker then traced the history of air conditioning and how medical men have come to appreciate its value. "It was proved conclusively that air conditioning was an aid to health and on this premise was the air conditioning of public buildings in Washington started.

"Then large office buildings were air conditioned, like the Philadelphia Electric Company and Chicago Tribune buildings. In these two structures, it was found that absenteeism of employees was cut down considerably by air conditioning."

Mr. Weisenbach said it was found that the expense of air conditioning was about $15 to $20 an occupant while attendance records of workers in these buildings was improved 27 to 30%. "Office buildings with air conditioning show a tremendous increase in occupancy," he declared.

The speaker then told of a survey which showed that 86% of users of air conditioning interviewed found air conditioning a profitable investment.

Micro-Organisms Cause Hay Fever

MEMPHIS — Tiny micro-organisms which make the nation's soil fertile were described as potential agents in causing hay fever.

When duststorms sweep over large areas of the country they carry billions of microscopic mold particles, similar to those which are found in yeast, and cause the sniffles and violent sneezing characteristic of hay fever, the Association of Allergists for Mycological Investigation reported recently at the Southern Medical Association's meeting here.

The association has organized observation stations throughout the Midwest and officials declared that its studies to date indicate that mold particles may prove to be as important as the pollen of various flowers and weeds in tracing hay fever causes.

These particles are extremely small, about one-tenth the size of a grain of ragweed pollen, but when a few of them are breathed into the nose they may begin to grow and set up irritations.

Mold particles are in the air all the time and not just at particular seasons of the year, like plant pollen, Dr. Marie B. Morrow and E. P. Lowe of the University of Texas declared. As a result some persons who are sensitive to both pollen and molds have hay fever throughout the year.

California Passes Apprentice Act

LOS ANGELES—The recently enacted California Trade Apprenticeship Act, which authorizes the formation of local joint apprenticeship committees for handling apprenticeship programs on a firmer and more reliable basis, is encouraging apprenticeship activity in southern California.

Assembly Bill 1570 went into effect September 19. It set up a supervised state program of apprenticeship training in all trades and provided a basis whereby the leaders of any industry or trade in any section of the state could form joint apprenticeship councils which would have supervision and direction over apprenticeship activity in their particular field of endeavor, under the jurisdiction of a State Apprenticeship Council. The new law provides that apprentices in any trade can, if desired by a certain industry, be indentured directly to the local joint apprenticeship committees, instead of, as was the practice in the past, being indentured to individual contractors. Under the law, now, an apprentice must devote a stipulated number of hours per year in classroom work in some reputable trade school, but may distribute the school hours through the year on any reasonable basis that will not diminish or detract from the training value of the course as a whole.

Tunnel Ventilation Is Reviewed at Chicago Meeting

CHICAGO—The first meeting of the Illinois chapter of the ASHVE for the 1939-40 season was held October 9, with 66 members and guests in attendance. The speaker of the evening was Loran D. Gayton, chief engineer for the City of Chicago, whose subject was "Ventilation of Underground Structures, including Subways."

Mr. Gayton traced man's progress in the art of tunnel building from the days of the early Romans up to the present day, and described the methods of ventilation employed through these periods varying from merely vertical shafts to the elaborate mechanical systems in use today.

The speaker described in detail some of the apparatus developed to combat the ventilation problems encountered in tunnel work and illustrated them with slides. He included figures on the quantities of lethal gases released by various explosives used in tunneling operations, of rock dust produced, and much other data of interest.

Following this very complete discussion of the problems involved in tunnel construction, Mr. Gayton went into the needs for ventilation of underground structures during their actual use. In general, the New York subways depend on the piston action of the trains to introduce air to the tunnel at stations and exhaust it between stations through sidewalk gratings at low velocities, but in some cases in order to avoid gratings in narrow sidewalks, air shafts and fan chambers are provided and the air is carried to the rear of properties acquired for that purpose. In some of the earlier subways in which two tracks were placed in the same tunnel, it was found necessary to install a separating wall between the tracks so that the piston action of trains operating in opposite directions would not be short circuited by the counter action of each other. Ventilating fans of capacity to exhaust the tunnel in 15 minutes are installed at intervals, but these are not used except in emergency where the trains could not operate.

The Chicago subway, being of the twin tube, single track design, is ideally adapted to ventilation by the piston action of the trains. Exhaust fans will be of capacity to exhaust the tunnel in five minutes, in case of fire.

Drinker Addresses Phila. ASHVE

PHILADELPHIA — The Philadelphia chapter, ASHVE, was addressed at its meeting on November 9 by Professor Philip Drinker, Harvard School of Public Health, who spoke on "Air Pollution."

$12 Million for State Buildings

SAN FRANCISCO—Proceeding on the premise that large-scale building construction produces increased activity in the heating field, California heating contractors are looking forward to a substantial volume of new business as their share of a $12 million statewide building program being undertaken by the California Division of Architecture, in different state departments, for completion by June 30, 1941.

Heating contractors expect to draw the largest volume of new business from the two dozen or more new building projects planned for southern, central and northern California, for which more than half of the total has been ear-marked. The contemplated new structures range from state prisons, colleges and industrial schools, to new highway patrol buildings in Los Angeles, San Francisco and Sacramento. In the southern California area, from Santa Barbara south, $3,807,232 has been awarded for 13 major building projects, with approximately $2,225,000 set aside for a dozen new construction jobs in other parts of the state. The largest project is the new State Prison for First Offenders at Chino, a $1,682,579 project, on which foundation work has been completed and work on the superstructure now underway.

A considerable portion of the balance of the $12,000,000 will be expended for repairs, additions and enlargements of existing institutions, and many of these projects likewise involve the installation of new heating systems or expansions to plants already in place.

Fleisher Speaks on Comfort A.C.

PITTSBURGH—The Pittsburgh chapter of the ASHVE met on November 18 with Walter Fleisher as the speaker of the evening. Mr. Fleisher spoke on the Significance of Air Conditioning Research for Human Beings. He told of his early experiences in air conditioning, and gave a general historical outline on the developments that lead to conditions requiring air control. Evolution of equipment, ventilating laws, air conditioning in the textile industry and air conditioning of movie houses were dealt with.

As chairman of the research committee he brought to the attention of the audience the changes in society research which first dealt with testing and rating heating equipment and later to the important work recently undertaken in carrying on research in the field of human comfort.

With cold therapy receiving considerable publicity lately, Mr. Fleisher stressed the importance of undertaking research in this new field.

MIT Builds Panel Heated Pool

CAMBRIDGE, MASS.—An unusual design in a swimming pool building is now under construction at the Massachusetts Institute of Technology and will be ready for use some time next spring. It has panel heating, and is the only swimming pool in the country which has this type of heating from both the ceiling and under the floor, as well as along one side. The structure is of brick, with a steel skeleton and cork insulation between walls. Dimensions are 92 x 130 feet, with the pool 42 x 75 feet.

In providing the panel heat from the floor, the method was to depress the structural concrete slab 5½ inches and then pour concrete fill around the pipes through which warm air is forced, thus securing a good bond, at the same time providing a separate slab so that should it be necessary to make an opening in the floor or tear up a part, the entire flooring would not have to be taken up. The heating pipes act as reinforcement for the upper slab, but steel bars reinforce the lower one. Floor heating is only through the decks around the pool, where swimmers walk barefoot.

Overhead heating is through a ceiling of acoustical material directly over the decks of the pool. A blanket of warm air is also provided along one side, where there is a window 28 x 95 feet in dimension, in 6-ft. lights set in steel mullions. This warm air blanket starts at eighteen inches from the floor and extends to the top of the window. Thus plenty of light is provided at the same time that all drafts are avoided. At the east exit two radiators are also provided.

Professor James Holt will conduct studies on the results of this panel heating for a period of about two years.

Newton Talks on Ice Conditioning

PHILADELPHIA—The Philadelphia section of the ASRE travelled to Reading, Pa., for its November meeting on the third. The program called for a visit in the afternoon to the Sunshine brewery. Dinner at the Berkshire Country Club was followed by talks on "Ice as a Medium for Air-Conditioning" by J. S. Newton, American Ice Company, and "Brewery Refrigeration" by Cyril Leach, Frick Company.

Epstein Discusses Odor Control

BUFFALO—Odor control and ventilation in Buffalo's new sewage disposal system were discussed by Harold Epstein, general manager of the system, in a talk before the Western New York chapter of the ASHVE in the University Club November 13.

15,964 Room Housing Project Proposed for N.Y.

NEW YORK—Mayor La Guardia announced on November 23 a housing project for the Navy Yard district of Brooklyn, estimated to cost between $22 million and $24 million. Shortly afterward a formal application and plans for the project were filed with the New York State Housing Authority, the first filed by the city.

The project will contain 3828 apartments with 15,964 rooms. It will be a model community in and of itself.

Mr. La Guardia said that since he took office in 1934, 3200 buildings had been demolished to make way for his housing program. He listed all of them, pointing out that the Bedford-Stuyvesant project had been resubmitted to Washington and was now under further consideration.

Toronto Chapter Hears Dunlop

TORONTO — The Ontario chapter, ASHVE, held its November meeting recently in the Royal York Hotel with a good attendance. The main address of the evening was delivered by P. J. Dunlop, of Hollinger Mines, who spoke on Mine Ventilation and Cooling.

M. W. Shears, reporting for the Code Committee, said that copies of the Steam and Hot Water Code had been sent to 24 municipalities during the summer.

Giesecke Addresses A.C. Bureau

BOSTON—Guest speakers at the November 21 meeting of the Air Conditioning Bureau, held jointly with Boston chapter, ASHVE, at the Walker Building, Technology, were Dr. F. E. Giesecke, vice-president of the ASHVE, and Dr. Hermann F. Arentz, economist of the United Business Service. Dr. Giesecke, who is director of the Texas Engineering Experiment Station at the State Agricultural & Mechanical College of Texas, spoke of Radiant Heating and Cooling.

Factory Building 3 Times Normal

TRENTON, N. J.—Reaching a record high for the second consecutive month, 80 plans for industrial building, calling for a total expenditure of $1,656,720, were approved during October by the New Jersey Department of Labor, according to announcement by State Labor Commissioner John J. Toohey, Jr. The number and valuation of plans approved is three times the average for the past 20 years. The current report shows 42 more plans than for the corresponding month a year ago, and $1,212,764 more than the value represented for the same period a year ago.

Giesecke Talks on Radiant Heating

NEW YORK—With one of the largest attendances of any meeting in recent seasons, the regular monthly meeting of the New York chapter of the ASHVE was held Nov. 20, with Dr. F. E. Giesecke, first vice-president of the Society, as the principal speaker. Dr. Giesecke's subject was Radiant Heating.

The speaker, with the aid of slides, developed his subject from the fundamentals, and in addition to describing progress and developments of radiant heating in this country gave a most interesting review of what has been done along these lines in Europe. He showed typical installations in England and Czechoslovakia. One of the interesting installations he described was that in a large department store in Prague where radiant heating is used in winter and radiant cooling in summer.

Dr. Giesecke described some of the work that has been done in the Agricultural and Mechanical College of Texas under his direction where the use of radiant heating hot water piping in the ceiling is being investigated from the standpoint of using the piping as reinforcing for the concrete.

Phila. Begins Gas Heat Campaign

PHILADELPHIA—An advertising campaign to stimulate the sale of gas heating equipment on the basis of recently reduced gas rates was launched here by the Philadelphia Gas Works Co., following recent announcement by the Philadelphia Gas Commission of the first gas heating rate reduction in some 19 years. A heavier promotional drive is planned for 1940, emphasizing the cheaper rate which, according to announcement, will make it possible to heat the average home with gas at a saving of almost 20% as compared with the previous rate.

H. S. Christman, general sales manager of the Philadelphia Gas Works, announced that "the local market has only 1% saturation so far as gas heating in the home is concerned. Heretofore the cost of gas heating made it available mainly to homes in the upper brackets. Now, however, the average Philadelphia home of five, six or seven rooms can afford the luxury and convenience of 100% automatic gas heat."

N.Y. to Publish Degree-Day Data

NEW YORK—The New York Weather Bureau has begun the publishing of degree-day figures for New York on its daily weather map and on its monthly meteorological summary, according to Benjamin Parry, meteorologist of the local Bureau.

WITH THE MANUFACTURERS

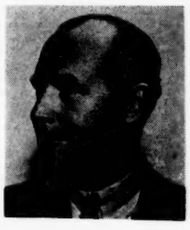
Line Losses in District Heating Explained to Boston NDHA

BOSTON — Illustrative of the growth in the use of steam service, H. U. Green, general manager of the Cambridge Gas & Electric Light Company, told members of Boston section, National District Heating Association, at its recent meeting November 23 that his company started underground steam service ten years ago with one customer—Harvard College. Now the company is delivering in excess of 600,000,000 pounds yearly to some ten customers. He warned distributors of such steam service, however, to calculate as far in advance as possible costs of delivering steam before extending mains, citing the steam loss on a small extension as around 18%. Sellers should divide the cost of extensions by the amount of total expected sales on the line. Some months steam loss would run as high as 75% on low use, and decrease with greater average use.

Other speakers included R. M. Nee on "Convention Nostalgia," A. L. Dutton on "Distribution," O. S. Pike on "Meters and Accessories," R. M. Nee on "Commercial Relations," and G. K. Saurwein on "Research." Chairman M. D. Engle presided.

C.A. Olsen Forms Furnace Company

ELYRIA, OHIO — A new company known as The C. A. Olsen Manufacturing Company has just been organized with headquarters here. The company has acquired a large local plant, owned by The American Rolling Mills Company, and is modernizing it.



C. A. Olsen

The company, which will manufacture gravity warm air furnaces, winter air conditioning units for gas, oil and coal, and blower units, will be headed by C. A. Olsen, formerly president of The Fox Furnace Company.

E. C. Carlson has been appointed secretary and treasurer of the new company. Mr. Carlson was for many years with the Lennox Furnace Company and later served as general manager of the Armstrong Furnace Company. Almon Chapin has been appointed production manager of the new company.

The new company will use the trade name Luxaire on its products.

NIAA Charters Its 20th Chapter

WATERBURY, MASS. — Continuing its program of growth, the National Industrial Advertisers Association on November 9 granted a charter to its twentieth chapter, the Industrial Advertising and Marketing Council of Western New England. The presentation meeting, in Hotel Elton, here, followed dinner and was well attended by members and guests.

Principal speaker of the evening was David Beard, manager of the direct mail department, McGraw-Hill Publishing Company. His topic was "Direct Mail—An Analysis of Results That Are Procurable When Direct Mail is Used Intelligently."

Officers and directors of the Industrial Advertising and Marketing Council are: president, E. V. Creagh, American Chain & Cable Co., Inc.; first vice-president, A. W. Tucker, The Henry G. Thompson & Son Co.; and second vice-president, C. H. Winslow, The Cuno Engineering Corporation.

Seelbach Elected by Gas Group

CLEVELAND — W. L. Seelbach, secretary and treasurer of the Forest City Foundries Company, has been elected chairman of the house heating and air-conditioning equipment division of the Association of Gas Appliance and Equipment Manufacturers.

W. L. Seelbach

As division chairman, Mr. Seelbach automatically becomes a director of the A.G.A.E.M.

U.S. Agency Approves Small Homes

WASHINGTON—A score of low cost, small house designs drafted by architects for the National Lumber Manufacturers Association and cooperating groups in the construction industry have been approved under the Federal Home Building Service, it was announced recently.

Homes built from these designs, if technically supervised throughout construction, will be eligible for registration with the Federal Home Loan Bank Board — certifying to the high type of design and construction and giving them a concrete evidence of value for resale.

To demonstrate that good homes can actually be built at prices ranging from $2500 to $5000, these homes have already been erected in Washington and a number of other communities, through the cooperation of lumber and other material dealers in a national homes demonstration program. In the Washington project prices ranged from $2418 for three rooms to $4095 for six rooms and a garage. These included grading, landscaping, walks and sodding but not the lot.

STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACTS OF CONGRESS OF AUGUST 24, 1912, AND MARCH 3, 1933, OF HEATING & VENTILATING, published monthly at New York, N. Y., for October 1, 1939.

State of New York, County of New York, ss.:

Before me, a Notary Public in and for the State and County aforesaid, personally appeared Edgar A. Becker, who, having been duly sworn according to law, deposes and says that he is the Treasurer of The Industrial Press, publishers of HEATING & VENTILATING and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of March 3, 1933, embodied in section 537, Postal Laws and Regulations, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:

Publisher, The Industrial Press, 140-148 Lafayette St., New York, N. Y.

Editor, C. H. B. Hotchkiss, 140-148 Lafayette St., New York, N. Y.

Managing Editor, Clifford Strock, 140-148 Lafayette St., New York, N. Y.

Business Managers, Robert B. Luchars, 140-148 Lafayette St., New York, N. Y.; Edgar A. Becker, 140-148 Lafayette St., New York, N. Y.; Erik Oberg, 140-148 Lafayette St., New York, N. Y.

2. That the owner is:

The Industrial Press, 140-148 Lafayette St., New York, N. Y.; Erik Oberg, 140-148 Lafayette St., New York, N. Y.; Robert B. Luchars, 140-148 Lafayette St., New York, N. Y.; Edgar A. Becker, 140-148 Lafayette St., New York, N. Y.; Laura A. Brownell, 140-148 Lafayette St., New York, N. Y.; Franklin D. Jones, 140-148 Lafayette St., New York, N. Y.; First National Bank and Trust Co. of Montclair and Robert B. Luchars, Trustees (Beneficiaries unknown), Upper Montclair, N. J.; First National Bank and Trust Co. of Montclair and Leigh Roy Urban, Trustees (Beneficiaries unknown), Upper Montclair, N. J.; First National Bank and Trust Co. of Montclair and Kenneth D. Ketchum, Trustees (Beneficiaries unknown), Upper Montclair, N. J.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are:

Laura A. Brownell, 140-148 Lafayette St., New York, N. Y.; John Connolly, 140-148 Lafayette St., New York, N. Y.; Franklin D. Jones, 140-148 Lafayette St., New York, N. Y.; Robert B. Luchars, 140-148 Lafayette St., New York, N. Y.; Louis Pelletier, 140-148 Lafayette St., New York, N. Y.; Elizabeth Y. Urban, 163 Western Drive, Longmeadow, Mass.; Helen L. Ketchum, King St., Cohasset, Mass.; Wilbert A. Mitchell, 28 Harlow Road, Springfield, Vt.; Henry V. Oberg, 1317 Hill Crest Road, R.D. No. 1, Lancaster, Pa.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

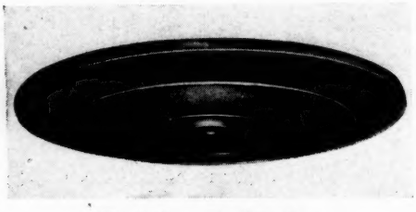
EDGAR A. BECKER, Treasurer.

Sworn to and subscribed before me this 25th day of September, 1939.

CHARLES P. ABEL.

Notary Public, Kings County No. 292; Kings Register's No. 1111; N. Y. County No. 217; N. Y. Register's No. 1-A-144. My commission expires March 30, 1941.

NEW EQUIPMENT



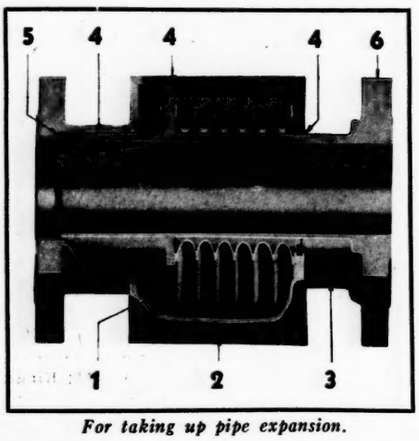
No draft or stratification.

Air Device Ceiling Outlet

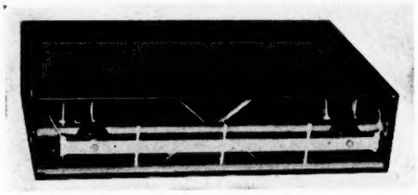
NAME—Agitair Temperature Equalizer.
PURPOSE — For introducing conditioned air into a room or space without draft or stratification.
FEATURES—Device consists of a series of circular spun aluminum members, designed to introduce conditioned air without draft or stratification. Manufacturer states that two shallow air streams are projected at high velocity at diverging angles, one horizontal and the other slightly downward. It is also claimed that the high velocity at the point of discharge supplies the energy necessary to produce a high rate of aspiration which in turn creates secondary air movement within space served to eliminate stratification. The diverging angles at which the air streams are projected are said to create a low pressure area between the two shallow streams that cause turbulence with the primary air blanket at ceiling. This turbulence is said to bring the primary air stream into contact with the room air to act as a brake on velocity and eliminate draft.
SIZES AND CAPACITIES—From 30 to approximately 11,000 c.f.m.
MADE BY—*Air Devices, Incorporated, New York, N. Y.* *1*

ADSCO Expansion Joint

NAME — ADSCO packless expansion joint, U-ring type.
PURPOSE—A packless joint for taking up expansion on pipe lines.
FEATURES—Sectional view illustrates the essential features of the joint which has an expansion element operating on the principle of cold springing used in the installation of pipe bends. The expansion element (1) is a series of welded U-rings of corrosion resistant steel which is welded to the steel body (2) and the guide (4) on the movable sleeve (3) to form a permanent seal between the stationary body and the movable sleeve. The element is compressed axially or cold sprung one-half of the total traverse for installation in the cold line. As the line expands with the application of heat the compression in the element is relieved and it passes through the neutral position and into tension for the remaining half of the traverse. The element is fully enclosed in a steel case to prevent dirt or scale from entering and is guided at three points (4) and a limit stop (5) prevents overtravel. It is furnished with flanged ends (6) or with beveled ends for welding for pressures up to 300 lb. with traverses of 1, 2, 3, and 4 inches in single joints.
MADE BY—*American District Steam Company, North Tonawanda, N. Y.*....*2*



For taking up pipe expansion.

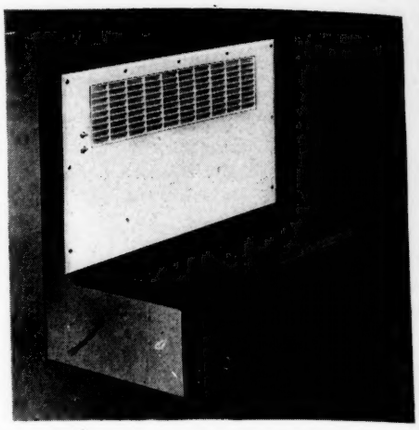


Air cleaning efficiency of 90% guaranteed.

Westinghouse Electrostatic Air Cleaning Equipment

NAME — Precipitron Electrostatic air cleaning equipment.
PURPOSE—For cleaning air.
FEATURES—This is a new line of redesigned and improved electrostatic air cleaning equipment for commercial and industrial uses. Two sizes of cells have been adopted as standard. One, a cell having an effective cross-section 8 in. x 18 in. with a cleaning capacity of 375 c.f.m. and an 8 in. x 36 in. cell with a capacity twice as great. From these two standard units, an air cleaning system for any given physical layout may be constructed. By the "Blackness test" as used by the National Bureau of Standards the larger cell has a guaranteed efficiency of 90% at 600 cu. ft. per min. and 85% at 750 cu. ft. per min.; the smaller cell is 90% efficient at 300 cu. ft. per min. or 85% at 375 cu. ft. per min.

Power packs are also available in two standard sizes: the type S for installations of 1 to 12 large Precipitron cells and the type L for installations from 12 to 50 large cells.
MADE BY—*Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.* *3*



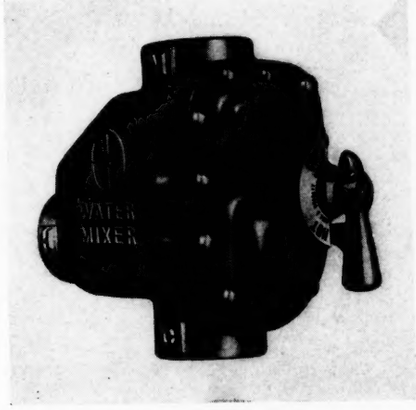
Winter air conditioning without ducts.

Crane Ductless A.C. Unit

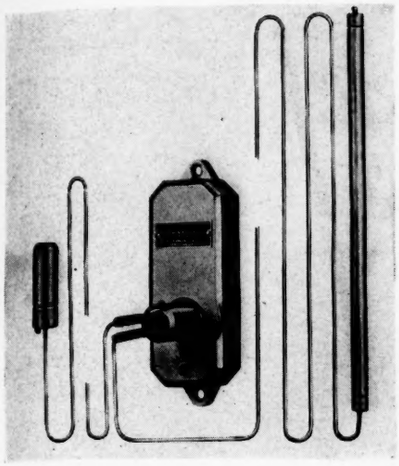
NAME — Newport ductless air conditioning unit.
PURPOSE—For ventilating, warming, humidifying and distributing air in the home.
FEATURES — Although this unit is primarily intended for winter conditioning, it can also be used in the summer for filtering and circulating the air. Manufacturer claims that it can be easily installed in new or old buildings as it is designed for installation in the corner of the floor and wall.
MADE BY—*Crane Company, Chicago, Ill.* *4*

Bell and Gossett Tempering Valve

NAME—Watermixer.
PURPOSE—For mixing hot and cold water to supply tempered water at a constant temperature.
FEATURES—Manufacturer states that the proportioning ability of this valve is not affected by differences in pressure drop. It is stated that since all working parts are made accessible by removing a cover plate, it is not necessary to remove the valve from the line when servicing is required.
MADE BY—*Bell and Gossett Company, Chicago, Ill.* *5*



For supplying tempered water.



Both inside and outside temperature controls heating.

Thrush Temperature Control

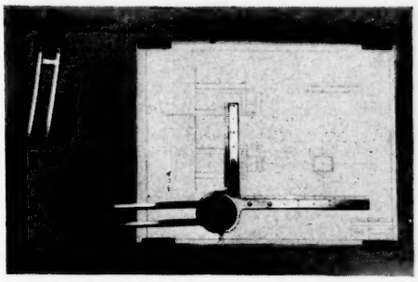
NAME & MODEL NO.—Thrush Differential temperature control, No. 210.
PURPOSE—For controlling the operation of forced circulation hot water systems in accordance with both inside and outside temperatures.
FEATURES—Control is said to automatically secure a balancing of indoor and outdoor temperatures. When heat is required control operates the circulator which sends additional heat into the building. When used on large buildings, one or more sections may be zoned, giving a better operating efficiency.
MADE BY—*H. A. Thrush & Company. Peru, Indiana.* 6

Western Silicair Duct Lining Sheets

NAME—Silicair duct lining sheets.
PURPOSE—For lining ducts to absorb sound and to reduce heat transmission.
FEATURES — These air duct lining sheets are said to have a high sound absorption rating at all frequencies, to be completely fire resistant, to be a good insulator, as well as dustless, smooth, light, strong and easily worked. The manufacturer states that they can be handled without gloves because they are absolutely free from slivers. The sheets are manufactured from a diatomaceous earth which is formed by a precipitation of almost pure silica from the porous shells of skeleton remains of diatoms. This earth is an off-white or pale grey substance resembling chalk and it weighs less and is said to be more porous than chalk. One cubic inch contains millions of diatoms, making a vast intricate cellular pattern which is stated makes it ideal for sound absorption purposes.
MADE BY—*Western Silicair Products, Inc., Burbank, Cal.* 7

Wrigraph Drafting Machine

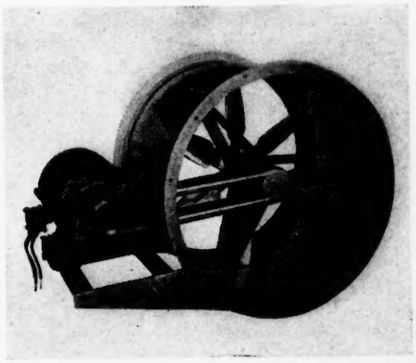
NAME AND MODEL NUMBER—Wrigraph drafter, Model D 520.
PURPOSE—For drafting.
FEATURES—This instrument will make drawings 20 x 26 in. or smaller. It is finished with a special tack-on mounted plate so that it can be fastened to any flat wooden surface and in any position. The protractor is of the 1 degree indicating type and a new kind of transparent edge, engine divided scale is used. Scales are interchangeable on the protractor head and all standard graduations are available. Instrument is equipped with adjustable ball bearings which are said to considerably increase the life of the machine. The entire machine can be knocked down and carried in a brief case. Price, including one set of scales, $19.00.
MADE BY—*L. G. Wright, Incorporated, Cleveland, Ohio.* 8



Brief case size drawing board.

South Bend Duct Fan

NAME—South Bend fan unit.
PURPOSE—For use in duct systems particularly where explosive gases are to be handled.

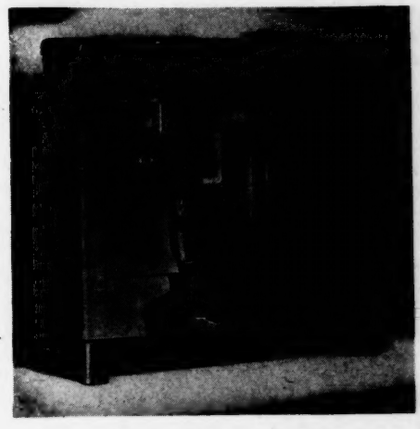


For explosive gases.

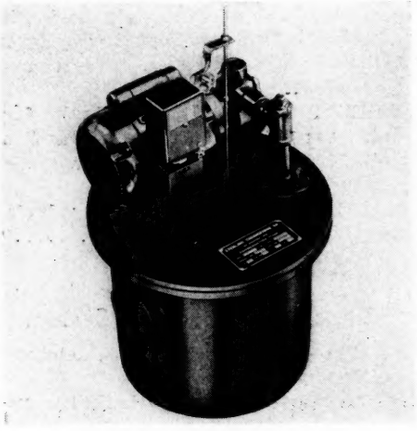
FEATURES—Motor is entirely out of the duct so that it will not be affected by the gas handled. Fans are furnished in both single and tandem types and require only a simple flange fitting for installation. Blades are of drop forged aluminum alloy and are said to be non-sparking. The motor support is integral with fan unit. Belt and all working parts are completely enclosed for protection. Belt tension is adjustable. When the unit is employed to handle acids, all exposed parts are covered with Heresite.
SIZES & CAPACITIES — Single fan unit from 1600 to 26,000 c.f.m. Tandem unit 1600 to 30,000 c.f.m. For static pressures up to 3 in.
MADE BY—*South Bend Air Products, Inc., South Bend, Indiana.* 9

Crane Basmor Heating System

NAME — Basmor Balanced-Sustained heating system.
PURPOSE—For heating buildings using gas as a fuel.
FEATURES—Heating system is of the single main, forced hot water type and is furnished complete by one source of supply. System consists of a Basmor gas-fired hot water boiler, Crane hot water circulator, Mono-flow fittings, Crane radiators or convectors and anticipating type thermostat. A Newport unit may also be used for providing humidification, filtration and circulation of air. The manufacturer states that the system provides a "sustained" or continuous supply of heat because the heating medium is hot water and the radiation surface cast iron. The manufacturer also claims that the system provides a "balanced" or controlled amount of heat since the water temperature is varied and the proper amount of heat is brought to radiator to meet room heat loss. It is stated that the boiler used with this system may be placed in basement or in kitchen, alcove or extra room. The boiler combustion chamber is completely surrounded by water passages while the burners are of the improved bunsen type.
SIZES—Complete range of sizes for small buildings.
MADE BY — *Boiler made by Bastian-Morley Co., Inc., La Porte, Indiana. Other parts made by—Crane Company, Chicago, Ill.*
DISTRIBUTED BY—*Crane Company. Chicago, Ill.* 10



Basmor gas-fired boiler.



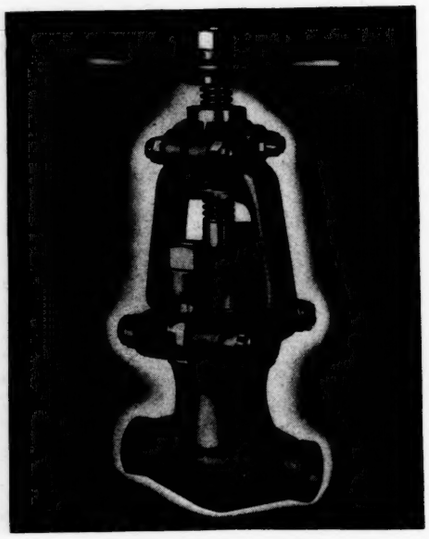
For automatic condensate return.

Sterling Condensation Pump

NAME—Sterling "Low Boy" condensation pump and receiver No. 4000.
PURPOSE—For collecting condensate from steam systems and returning it to the boiler.
FEATURES—This is a low cost unit made up of a combination receiving tank and float switch control pump. It is constructed with a cast iron receiver and powered with a one-sixth hp., ball bearing, brushless motor. It is compactly designed and adaptable for installation either above or below ground.
CAPACITIES—1500 sq. ft. EDR at 30 lb. per sq. in. 3300 sq. ft. EDR at 10 lb. per sq. in.
MADE BY—*Sterling Engineering Company, Milwaukee, Wis.* *11*

Hancock Valve

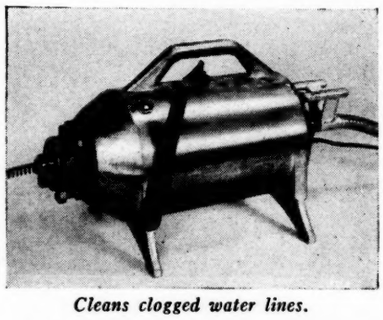
NAME — Hancock "No-Bonnet-Joint" valve.
PURPOSE—For handling fluids which may prove dangerous if leakage occurs.
FEATURES—Valve has been developed to end leakage through the gasket joint between the valve body and bonnet at elevated pressures and temperatures. It does this because there is no joint. Valve has no threads, has Stellite seat and Stellite valve disc. Designed for pressure up to 2500 lb. at 1000F.
SIZES—Made in one basic size and then tapped or bored for welding for ½ in., ¾ in., and 1 in. pipe.
MADE BY—*Hancock Valve Division of Manning, Maxwell & Moore, Inc., Bridgeport, Conn.* *12*



Has no bonnet jacket.

Pittsburgh Pipe Cleaner

NAME—Water line cutter.
PURPOSE—A cutter for use with the Pittsburgh pipe cleaning machine for opening and cleaning clogged water lines and fittings as small as ½ in. in diameter.
FEATURES—This new cutter which is designed to fit on the rotating cable of the "A" model electrically driven Pittsburgh pipe cleaning machine is said to make possible the opening and cleaning of clogged water lines and fittings as small as ½ in. in diameter as well as to pass through 90 degree ells and either direction in tees. The "A" machine which is shown, is the smaller of the two models offered by this company. It weighs 45 lb. and has an overall length of 17½ inches. The operation consists in fitting the required length of coiled cable and cutter into the pipe and rotating the cable by machine at 1100 r.p.m. and feeding more into the line by hand until obstruction is cleared. Manufacturer states that the "A" machine can be used for clearing 1½-in. to ½-in. water lines. The larger machine is said to be able to clean lines as large as 6 inches.

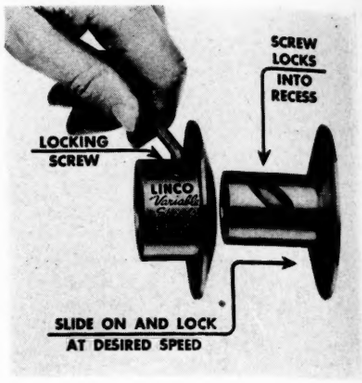


Cleans clogged water lines.

MADE BY — *Pittsburgh Pipe Cleaner Company, Pittsburgh, Pa.* *13*

Linderme Variable Speed Pulley

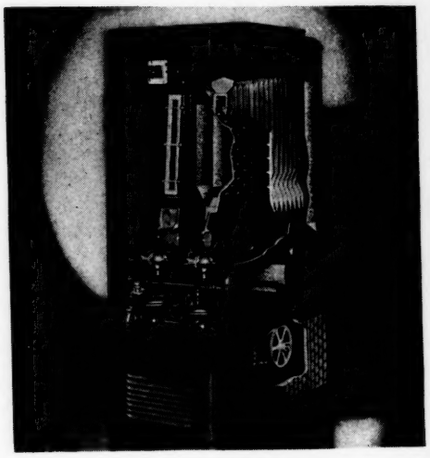
NAME—Linderme variable speed pulley.
PURPOSE—A V-type belt pulley which may be quickly adjusted to give a variation of speeds.
FEATURES—Two separate parts of this pulley are sleeve fitting so that they slide together. This design, the manufacturer states, results in an accurate adjustment and truer running pulley. Only one locking screw is required, which by a turn of an Allen wrench, tightens into a recess and securely locks the pulley in the desired adjustment. The manufacturer claims that this design allows for a maximum of speed variations and shortens the time usually taken to adjust pulleys from one speed to another.
MADE BY—*The Linderme Machine and Tool Co., Inc., Detroit, Mich....14*



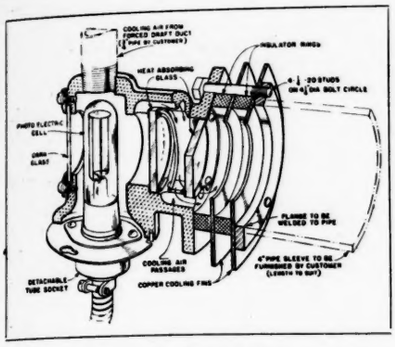
Gives wide range of speeds.

Basmor Warm Air Conditioners

NAME—Basmor gas fired, warm air furnace, Hi-model.
PURPOSE—For supplying warm humidified air using gas as a fuel.
FEATURES — This unit is designed particularly for applications where space is at a premium. It requires a minimum of floor space and can be installed in ventilated closets, behind partitions or in any other available space either on the same level with the space to be conditioned or in the space above. The unit will heat, humidify, clean, as well as circulate air.
SIZES AND CAPACITIES—Three sizes of capacity ranging from 52,000 to 144,000 B.t.u. per hour output at bonnet.
MADE BY—*Bastian-Morley Co., Inc., La Porte, Indiana.*
DISTRIBUTED BY—*Crane Co., Chicago, Ill.* *15*



For use in limited spaces.



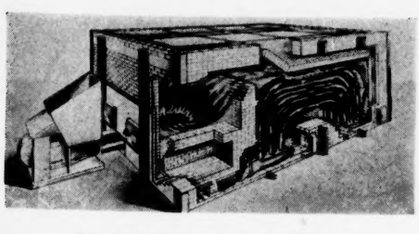
Warns of flame failure.

Bailey Flame Detector

NAME—Bailey Flame Detector.
PURPOSE—For warning a boiler operator of possible furnace explosion which may result from loss of ignition.
FEATURES—Device consists of a light sensitive phototube unit within a special air-cooled housing which is mounted on the burner front or the boiler wall so that the phototube "sees" the flame at the point where ignition begins to take place. As long as the burner continues to maintain ignition, light from the flame reacts on the phototube causing it to have a low electrical resistance and thereby maintain a flow of current through a relay. In case of flame failure, the phototube resistance increases sharply so that the relay operates to close or to open contacts for sounding alarm. In addition to showing complete loss of ignition, the detector also indicates spotty or streaky flame resulting from intermittent or unsatisfactory fuel feed.
LITERATURE AVAILABLE—Bulletin No. 210.
MADE BY—*Bailey Meter Company. Cleveland, Ohio.* *16*

Lee Direct Air Heater

NAME—Lee Central system direct air heater.
PURPOSE—A direct type heating system using any type of fuel and designed for heating large and spacious buildings such as factories, hangars, garages, or churches.
FEATURES—The Lee system makes use of a centrally located air heater consisting of a combustion chamber, a bank of heater tubes, and an air circulating fan and an induced draft fan, both fans being mounted on the same motor shaft. Air from the building or air from the outside, or any proportional mixture of the two, is forced through the tubes and the warm air thus generated is delivered by means of ducts. Manufacturer states that the induced draft stack is small, and the heater can be installed anywhere and at any level. Construction depends upon the size, the larger units being brick encased and the smaller units steel-clad. It is stated that with coal, oil, gas, waste, lignite or other fuels, furnace can be fired either by hand or by the usual automatic devices. Manufacturer claims that the system is relatively inexpensive to install, utilizes fuel with a high degree of efficiency, responds quickly without over shooting, requires little or no maintenance and needs no licensed attendants.
MADE BY—*Lee Engineering Company. Youngstown, Ohio.* *17*



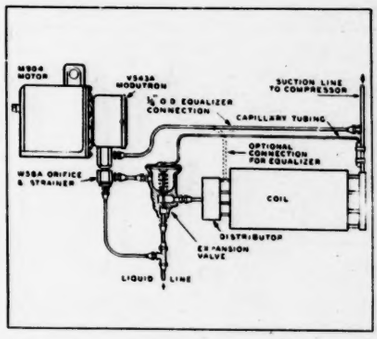
For heating spacious buildings.

M-H Air Conditioning and Control System

NAME—M-H Modutron system.
PURPOSE—For modulating the flow of liquid refrigerant to cooling coils.
FEATURES—The Modutron system may be applied to any refrigeration installation employing a thermostatic expansion valve with an external equalizer. A small electrically operated valve, known as the V543 Modutron, is installed in the equalizer line of the thermostatic expansion valve. The electric motor which operates the valve is modulated by temperature, humidity, pressure or any other condition to be controlled and opens the valve wide when maximum cooling is required. Under these conditions, the refrigeration system operates in a normal manner. When less refrigerating effect is required, the electric motor moves the valve to a more closed position, reducing the effect of the external equalizer on the expansion valve. As a result the expansion valve operates at a higher super-heat. When the Modutron is completely closed, the expansion valve is affected only by the pressure of the refrigerant leaving the valve, and on most systems, the capacity will then be reduced to about 60% or 70% of full load capacity.

On jobs requiring further reduction of capacity, the W 58 orifice may be added. This orifice bleeds a small constant quantity of liquid into the pressure chamber of the expansion valve from the liquid line. The addition of the W 58 orifice to the V 548 Modutron gives modulation from full capacity down to between zero and 20% depending upon the characteristics of the expansion valve.

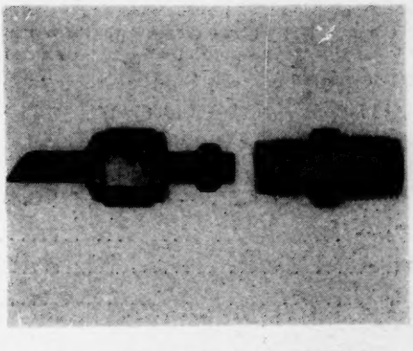
The manufacturer states that since the capacity reduction is secured without changing the air velocity over the coil, it is possible to modulate to a lower suction pressure than otherwise without danger of frosting the evaporator.
MADE BY — *Minneapolis-Honeywell Regulator Co., Minneapolis, Minn...18*



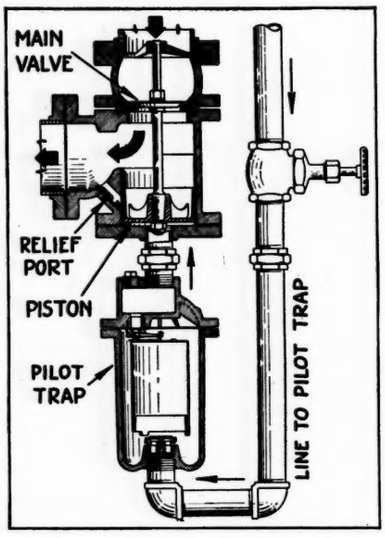
Controls refrigerating flow to cooling coil.

VibraSeal Pipe and Tube Connections

NAME—VibraSeal pipe and tube connections.
PURPOSE—For connecting copper, aluminum or steel tubing to pipe threaded holes and at the same time to protect against tube fatigue, failures, and vibration.
FEATURES—Manufacturer states that this is a new method of connecting tubing to pipe threaded holes and offers the following advantages; protects against tube fatigue, dampens vibration, noise and heat flow and requires no flaring. A threaded nipple is screwed into the threaded or tapped hole, a VibraSeal (rubber-like gasket) is placed on the tubing and a locknut used to compress the VibraSeal to form a flexible seat. The manufacturer states that the connection can be made even if the tubing is not in precise alignment. The gasket is claimed to be impervious to the action of oils, gasoline or gases.
SIZES AVAILABLE—For tube sizes from ⅛ in. to 2 in. outside diameter and in systems designed to hold up to 300 to 400 lb. static pressure.
MADE BY—*VibraSeal Corporation, Detroit, Mich.* *19*



For connecting tubing to threaded holes.



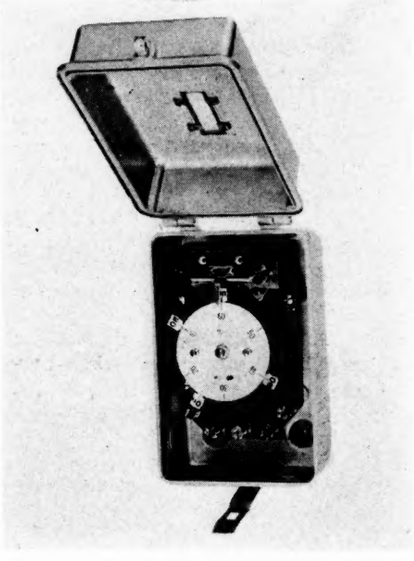
300,000 lb. condensate per hour.

Armstrong Giant Steam Trap

NAME—Armstrong Giant steam trap.
PURPOSE—For automatic drainage of large amounts of condensate.
FEATURES—Trap has 6 in. pipe connections and is rated at a continuous flow of 300,000 lb. of water per hr. at 50 lb. pressure. Unit consists of a large inverted bucket type pilot trap and a piston operated main valve. The main valve assembly is installed as an elbow in the drain line. The pilot trap is connected to the drain line at a point above the main valve assembly. In this manner the main valve is kept sealed with water. The manufacturer states that the use of the inverted bucket type pilot trap makes the unit non-air binding. In operation, the condensate from the pilot trap discharges against the piston of the main valve forcing the piston upward until the relief port is uncovered. Upward movement of the piston is checked by using the piston skirt to cut down the area of the main outlet port. Snap action closing takes place when steam instead of water starts coming into the pilot trap and causes it to close.
MADE BY—*Armstrong Machine Works, Three Rivers, Mich.* *20*

Cramer Cycle Timer

NAME—Type C.T. cycle timer.
PURPOSE—For automatic timing the operation of stokers, thermostats and like equipment.
FEATURES—This timer has been designed for use on alternating current circuits to either close or open a single circuit at any pre-set operating interval or to alternately close or open two circuits at any pre-set operating interval, one circuit operating instantaneously with the closing of the other and vice versa. Among the features claimed are (1) a variety of time ranges—there being 8 different time scales ranging from one revolution in 60 seconds to one revolution in 24 hours. (2) the number of operations—each dial being equipped with 4 operating arms so that either one or two cycles can be obtained in one revolution of the dial. (3) ready adjustment. (4) the timing motor which will start on a plus or minus 20% of the rated voltage. (5) a switch mechanism has a definite snap action.
MADE BY—*The R. W. Cramer Company, Inc., Centerbrook, Conn.* *21*



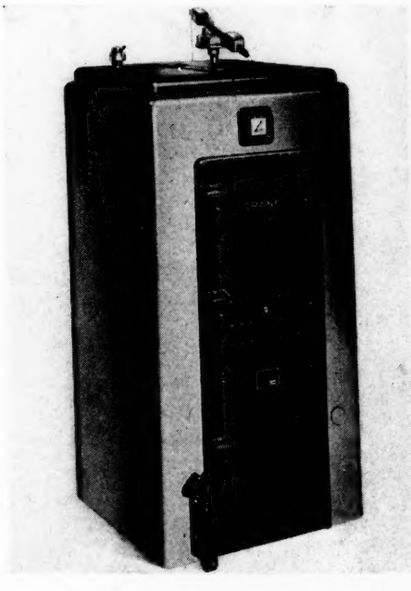
For timing equipment.

Oil City Fire Observer

NAME—"Oil City" Fire Observer.
PURPOSE—For inspection of fuel bed, furnace walls, and tubes without admitting cold air into furnace.
FEATURES—Fire observer has a wide opening or port covered on the inside by a shutter, with all infiltration of air eliminated. When the shutter is raised, the port is opened and the colored Pyrex glass on the outside diffuses the glare and permits a safe, clear vision of the furnace. When the handle is released, the cover closes the port. The fire observer is equipped with a Monel metal screen inserted in back of the lens, which protects it when the shutter is opened.
MADE BY—*Oil City Tank & Boiler Company, Oil City, Pa.* *22*

Two Crane Boilers

NAME & MODEL NO.—Crane boilers No. 10 and No. 110.
PURPOSE — For supplying steam or hot water using either coal or coke, oil or gas.
FEATURES—No. 10 boiler is designed for use with either coal, coke, oil or gas and the manufacturer says it is a simple matter to convert from one fuel to another. A 12 in. high grate and removable grate lugs facilitate conversion. A green jacket is provided for the boiler. No. 110 boiler is designed primarily for hand firing of coal, although it can be converted to stoker or oil burning. A patented feature on both boilers is its "controlled water travel" whereby it is claimed more heat is secured with no increase in fuel consumption.
MADE BY—*Crane Company, Chicago, Ill.*.....*23*



No. 110 Crane boiler.

TO OBTAIN FURTHER INFORMATION ON NEW EQUIPMENT

On the list below circle the item number of the equipment in which you are interested, using the number found at the end of each item.

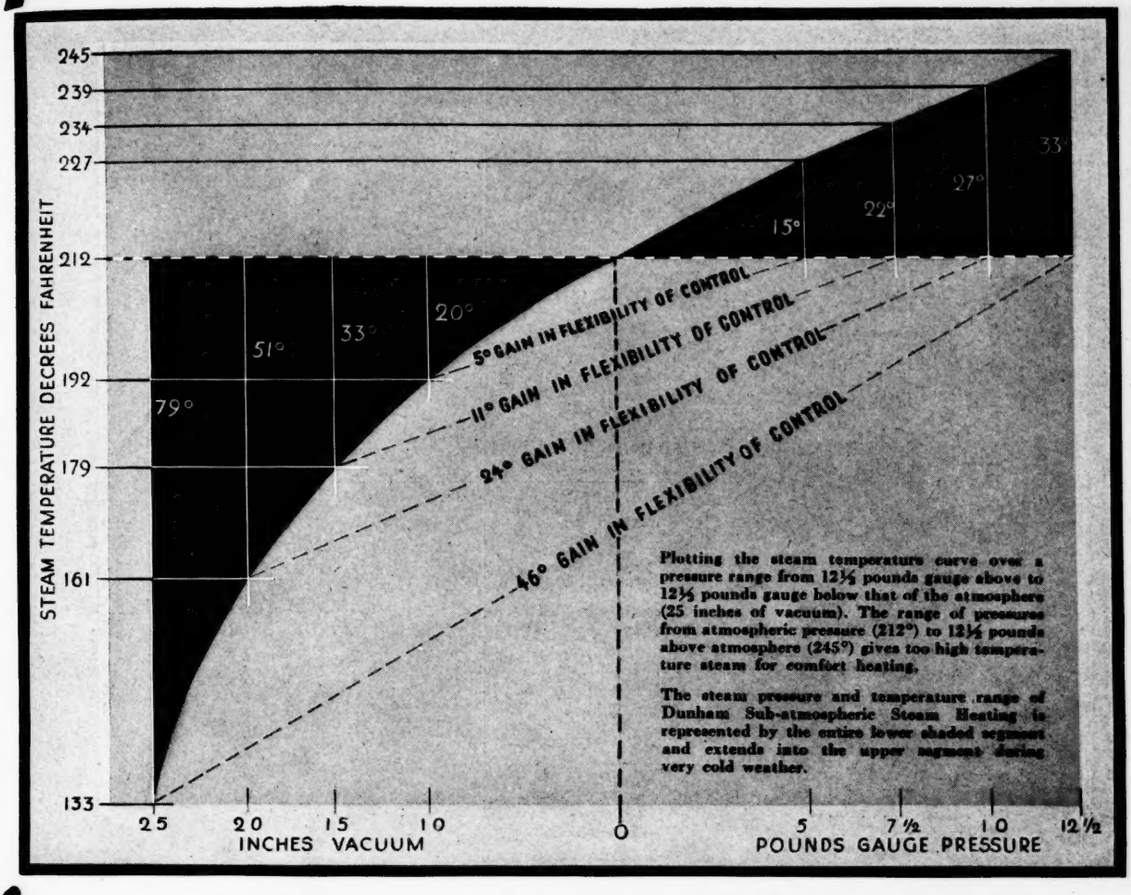
1 2 3 4 5 6 7 8 9 10 11 12 13 14
15 16 17 18 19 20 21 22 23

(This service available only to engineers or executives)

Fill in your name and address, detach and mail to HEATING & VENTILATING, 148 Lafayette St., New York, N. Y.

Name.....
Title.....
Firm.....
Business Address .....
City and State 12/39

Check COMFORT CONDITIONING BY DUNHAM



Against THE STEAM TABLE . . .

"WHAT," asked a Building Manager of the Consulting Engineer, "are your stipulations for *Good Heating?*"

He replied, "The steam table shows that the pressure of steam is the index of its temperature; therefore, we require a system that will automatically circulate steam under all pressures from the coolest of *below atmosphere levels* to the hottest of *high pressure degrees* to meet, degree for degree, all vagaries of weather. Volume must also be controlled."

There is such an "Engineer's" system **— it is known as Dunham Sub-atmospheric Steam Heating. It ends the common American fault of over-heating by controlling both the temperature and the volume of the steam circulated, from fractional to full-filling of the system. It eliminates window-opening for cooling; it makes unnecessary radiator adjustment for relief from too-hot or too-cold radiators; it prevents the scorched air that is so commonplace in buildings on the mild days of winter. To the major stipulations of the engineer it adds the practical advantage of extreme fuel economy. It is used to modernize old systems as frequently as it serves new installations. We invite your correspondence. C. A. Dunham Company, 450 East Ohio Street, Chicago.**

COMFORT CONDITIONING by DUNHAM

CONSULT THE ARCHITECT FOR GOOD DESIGN AND THE CONSULTING ENGINEER FOR MECHANICAL EQUIPMENT

Degree-Day Figures for October, 1939

With this issue HEATING & VENTILATING continues its twelfth year of publishing degree-day data for various large cities

	Albany, N. Y.	Atlanta, Ga.	Baltimore, Md.	Birmingham, Ala.	Boston, Mass.	Buffalo, N. Y.	Burlington, Vt.
Degree-days for October, 1939	504	105	227	100	352	404	542
Degree-days, Sept. 1, '39 to Oct. 31, '39	666	108	240	100	441	542	780
Degree-days, Sept. 1, '38 to Oct. 31, '38	597	97	225	73	409	548	774
Degree-days, Sept. 1 to Oct. 31, Normal	518	96	223	—	411	494	625

	Cheyenne, Wyo.	Chicago, Ill.	Cincinnati, Ohio	Cleveland, Ohio	Columbus, Ohio	Denver, Colo.	Des Moines, Iowa
Degree-days for October, 1939	506	324	255	314	292	323	333
Degree-days, Sept. 1, '39 to Oct. 31, '39	681	376	270	379	313	384	410
Degree-days, Sept. 1, '38 to Oct. 31, '38	625	324	286	380	317	341	256
Degree-days, Sept. 1 to Oct. 31, Normal	845	356	248	393	313	500	357

	Detroit, Mich	Dodge City, Kan.	Duluth, Minn.	El Paso, Tex.	Erie, Pa.	Evansville, Ind.	Fort Wayne, Ind.
Degree-days for October, 1939	399	200	680	72	344	173	360
Degree-days, Sept. 1, '39 to Oct. 31, '39	507	247	947	72	439	185	431
Degree-days, Sept. 1, '38 to Oct. 31, '38	468	167	709	36	421	160	367
Degree-days, Sept. 1 to Oct. 31, Normal	442	276	881	40	414	155	347

	Fort Worth, Tex.	Grand Rapids, Mich.	Green Bay, Wis.	Harrisburg, Pa.	Hartford, Conn.	Indianapolis, Ind.	Ithaca, N. Y.
Degree-days for October, 1939	34	398	496	314	387	260	437
Degree-days, Sept. 1, '39 to Oct. 31, '39	36	506	665	353	483	292	565
Degree-days, Sept. 1, '38 to Oct. 31, '38	35	412	495	352	397	286	600
Degree-days, Sept. 1 to Oct. 31, Normal	—	476	637	329	392	298	539

	Kansas City, Mo.	Knoxville, Tenn.	La Crosse, Wis.	Lansing, Mich.	Lincoln, Neb.	Little Rock, Ark.	Los Angeles, Calif.
Degree-days for October, 1939	191	132	444	452	284	111	17
Degree-days, Sept. 1, '39 to Oct. 31, '39	226	133	571	600	346	117	17
Degree-days, Sept. 1, '38 to Oct. 31, '38	161	153	413	546	198	75	27
Degree-days, Sept. 1 to Oct. 31, Normal	214	183	558	595	316	47	—

	Louisville, Ky.	Madison, Wis.	Memphis, Tenn.	Milwaukee, Wis.	Minneapolis, Minn.	Nashville, Tenn.	New Haven, Conn.
Degree-days for October, 1939	186	422	113	387	542	139	354
Degree-days, Sept. 1, '39 to Oct. 31, '39	194	530	121	481	691	146	430
Degree-days, Sept. 1, '38 to Oct. 31, '38	211	432	83	403	442	131	361
Degree-days, Sept. 1 to Oct. 31, Normal	186	546	62	534	574	136	399

	New Orleans, La.	New York, N. Y.	Norfolk, Va.	Oklahoma City, Okla.	Omaha, Neb.	Peoria, Ill.	Philadelphia, Pa.
Degree-days for October, 1939	26	293	129	89	309	305	264
Degree-days, Sept. 1, '39 to Oct. 31, '39	26	317	129	101	376	354	280
Degree-days, Sept. 1, '38 to Oct. 31, '38	7	271	161	87	224	287	237
Degree-days, Sept. 1 to Oct. 31, Normal	—	276	99	105	329	384	242

	Pittsburgh, Pa.	Portland, Me.	Portland, Oreg.	Providence, R. I.	Reading, Pa.	Reno, Nev.	Richmond, Va.
Degree-days for October, 1939	297	472	264	359	314	398	214
Degree-days, Sept. 1, '39 to Oct. 31, '39	327	642	323	443	357	398	217
Degree-days, Sept. 1, '38 to Oct. 31, '38	335	566	259	379	333	493	229
Degree-days, Sept. 1 to Oct. 31, Normal	313	563	437	411	344	597	158

	Rochester, N. Y.	St. Louis, Mo.	Salt Lake City, Utah	San Francisco, Calif.	Scranton, Pa.	Seattle, Wash.	Spokane, Wash.
Degree-days for October, 1939	413	183	351	119	424	338	481
Degree-days, Sept. 1, '39 to Oct. 31, '39	530	199	409	200	524	467	599
Degree-days, Sept. 1, '38 to Oct. 31, '38	524	152	312	244	492	374	486
Degree-days, Sept. 1 to Oct. 31, Normal	503	205	406	260	457	595	707

	Springfield, Ill.	Syracuse, N. Y.	Toledo Ohio	Trenton, N. J.	Utica, N. Y.	Washington, D. C.	Wichita, Kan.
Degree-days for October, 1939	242	414	358	313	441	255	150
Degree-days, Sept. 1, '39 to Oct. 31, '39	270	532	433	352	556	268	189
Degree-days, Sept. 1, '38 to Oct. 31, '38	207	548	401	315	605	258	124
Degree-days, Sept. 1 to Oct. 31, Normal	282	521	378	242	612	251	192

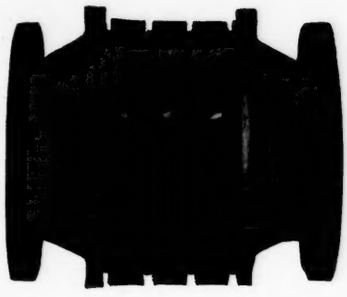
Methods of applying the degree-day in connection with the operation of heating plants or for the prediction of fuel consumption of heating plants are described fully in the new enlarged edition of the DEGREE-DAY HANDBOOK, published by HEATING & VENTILATING, 148 Lafayette Street, New York, price $3. Degree-days as given above for a "normal" month or season are based on averages for a long period of years, ending about 1922. Averages covering different periods will disagree with the above figures slightly.

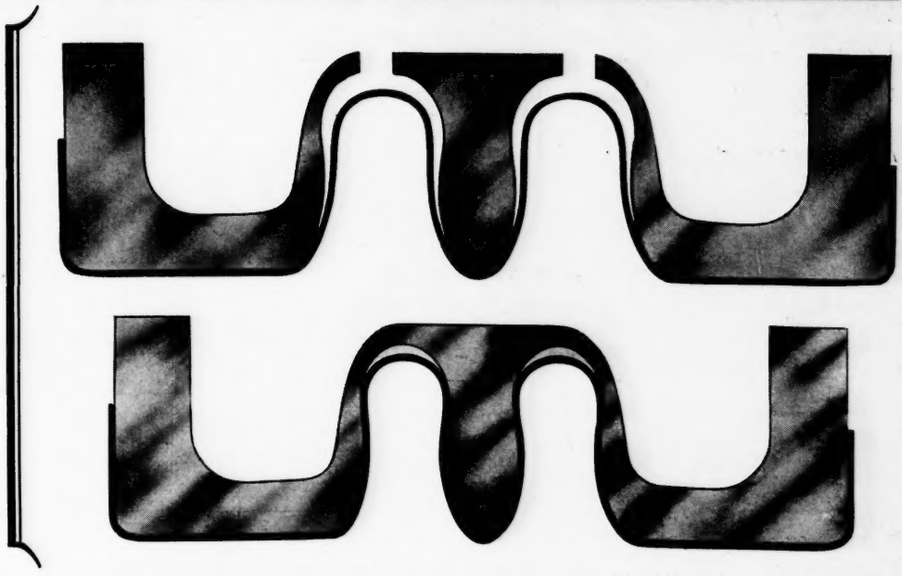
DIRECTED FLEXING

in the *Expansion Joints* made by

E. B. BADGER & SONS CO.

. . . *and Your Purchasing Dollar*





Corrugated types of expansion joints now on the market have two distinctly different designs of corrugations. One is the all-curve, Directed Flexing corrugation that features the BADGER Expansion Joint of today. The other is the straight-sided corrugation such as typified the BADGER Expansion Joint of some years ago. Let's discuss the difference and see how it affects your purchasing dollar.

By means of photomicrographic pictures and metallurgical studies of the metal from used expansion joints with straight-sided corrugations we discovered a well-pronounced tendency on the part of flexing stresses to localize at the points of tangency. Obviously, this shortened the life of the joint. The problem was to design a corrugation and equalizing ring that would not permit these stresses to localize.

The fruit of this research is the Directed Flexing corrugation and equalizing ring. Extensive tests and years of operation have proved conclusively that this design does prevent stresses from localizing. The movement of metal, instead of being accordion-like, is more of a wrapping action with the rings serving to direct and control the movement. A study of the sections above will make this clear.

The Directed Flexing design is one of the plus values you get when your purchasing dollar goes into maintenance-free expansion joints made by . . .

Other BADGER Features

Scientifically Applied Heat Treatment throughout Fabrication.

Wide Range of Traverse Capacities.

Line of Stainless Steel as well as Copper Expansion Joints.

No Packing Required.

E. B. BADGER & SONS CO.

75 PITTS STREET, BOSTON, MASS.

Agents in Principal Cities

Summer Degree-Hours for 1939

THE number of variables which affect the summer air conditioning load is high, and the dry-bulb temperature of the outside air is of much less importance among the other variables than it is in connection with winter heating. It is doubtful if any one single factor can ever be used to show load proportionality for different types of buildings in the summer as it can in winter with the degree day.

However, where there is little internal load, either sensible or latent, such as in residences, some such simple proportionality may exist. Research at both University of Illinois and by Detroit Edison Company indicates that the load unit for residences for summer may be the summer degree-hour above 85F.

The figures below show the number of degree-hours of current interest for a number of cities.‡ To obtain them, 85 was subtracted from the hourly temperatures for each hour it was over 85F, and results totaled.

The first two columns of figures are the degree-hours totaled for October, 1939 and October, 1938. The third and fourth columns show the maximum and minimum number of degree-hours experienced during the Octobers in the eight-year period from 1932 to 1939.

The fifth and sixth columns show the cumulative totals for the summer (1939 and 1938) up to and including October 31. The last two columns show these cumulative seasonal totals *for the year having the highest and lowest cumulative total up to October 31.*

Fourteen of the 31 cities listed below had the hottest October (as indicated by degree-hours) this year of any over the 8-year-period covered by the records. These cities were scattered throughout the country from San Diego to Philadelphia. Three of the cities—Houston, San Diego and San Francisco—had, during 1939, the highest seasonal total of record, while Birmingham set a new low seasonal total record.

‡Maximum, minimum, and average seasonal totals of summer degree hours are included in both tabular and map form in the Air-Conditioning Engineers' Atlas, by Strock and Hotchkiss, The Industrial Press, 148 Lafayette St., New York. Price, $2.

SUMMER DEGREE-HOURS (ABOVE 85F)*

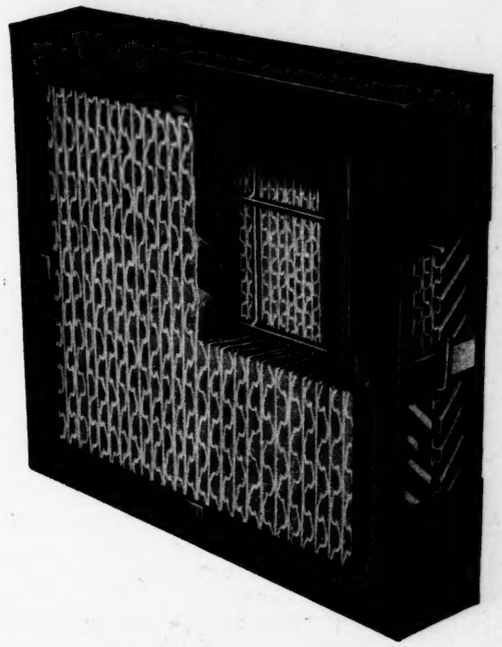
OCTOBER, 1939, AND 1939 SUMMER TOTALS

CITY	OCT., 1939	OCT., 1938	OCT., MAX.†	OCT., MIN.†	SEASONAL TOTAL TO OCT. 31			
					1939	1938	MAX.†	MIN.†
Baltimore	82	16	82	0	1614	1394	2181	1080
Birmingham	30	303	72	0	1841	2368	3906	1841
Bismarck	0	2	9	0	1247	1035	4633	1035
Boston	3	4	4	0	319	358	734	204
Buffalo	0	0	0	0	36	17	113	11
Chicago	0	0	0	0	831	337	1797	337
Cincinnati	45	1	45	0	1212	705	3344	705
Cleveland	7	0	7	0	301	142	710	142
Columbus	34	0	34	0	1464	969	2797	854
Des Moines	29	68	68	0	2380	2523	6560	1502
Detroit	8	0	8	0	809	340	1879	340
Ft. Wayne	14	0	14	0	1016	353	2741	353
Grand Rapids	0	0	0	0	814	293	1901	293
Houston	86	497	212	21	4570	3078	4570	2938
Indianapolis	17	1	17	0	1483	672	4432	672
Kansas City	161	205	205	0	5338	5109	12399	2562
Memphis	37	441	64	0	2675	3002	4722	2061
Milwaukee	0	0	0	0	691	233	1090	233
Minneapolis	0	1	1	0	1040	541	3017	541
New Orleans	71	84	84	1	2811	3121	3469	2087
New York	3	7	7	0	253	214	560	75
Philadelphia	16	11	16	0	786	591	1340	577
Pittsburgh	1	0	1	0	458	365	1262	293
Portland, Ore.	0	0	9	0	793	589	851	183
Richmond, Va.	91	5	91	0	1418	943	2453	943
St. Louis	53	76	76	0	2390	3028	8361	2388
San Diego	37	0	37	0	456	3	456	0
San Francisco	4	0	46	0	201	4	201	4
Savannah	85	4	85	1	3194	2967	3528	2320
Toledo	15	0	15	0	720	445	2064	581
Washington	51	2	51	0	1387	1194	1945	1194

*Computed from data made available through the cooperation of the U. S. Weather Bureau.
†See text for definition of this term.

Improved

DETROIT AIR FILTER



● The design and the choice of materials for the Improved Detroit Filter provide high dust removal capacity and unusually long service life. Air resistance, which is extremely low initially, increases only very gradually during the service life of the filter. Thus the Detroit Filter which carries a low initial cost is one of the most economical units available.

Write for Bulletin No. 187

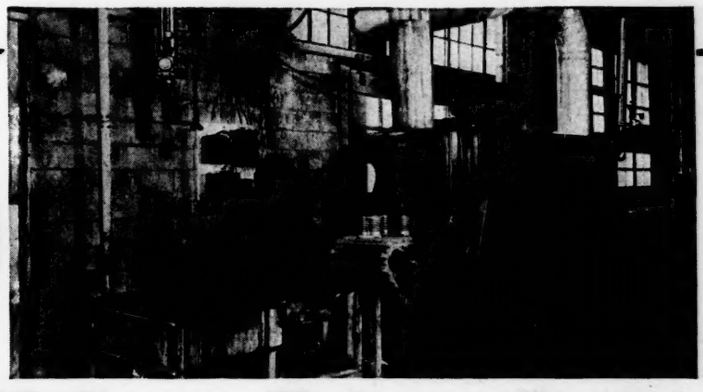
DETROIT LUBRICATOR COMPANY

General Offices: DETROIT, MICHIGAN

Canadian Representatives: RAILWAY AND ENGINEERING SPECIALTIES LIMITED

Montreal • Toronto • Winnipeg

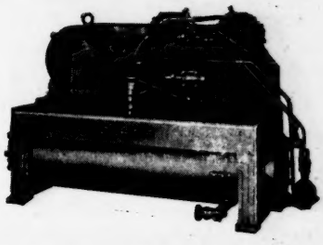
Why **CURTIS** is the Extra Value Line



Where CURTIS Parts Take a Bath!

This illustration shows the giant washing machine (capacity 325 g.p.m.) in the Curtis factory, where machined parts and castings pass through a multiple shower bath and are deluged with a boiling hot chemical solution which removes all grease, oil and metal particles. The heat imparted to the parts in washing assures thorough drying before the end of the process, following which all bright parts are dipped in an anti-rust bath before being used or placed in stock.

Thus another remarkable piece of equipment contributes to the extra value you'll always find in every Curtis product —with every manufacturing and finishing process performed in the complete Curtis plant under careful, accurate supervision. The result is the long life, exceptionally high efficiency and dependable performance characteristic of every Curtis condensing unit.



The Curtis 15 H.P. Shell and Tube Condensing Unit

CURTIS REFRIGERATING MACHINE CO.

1999 Kienlen Ave. St. Louis, Mo.

CURTIS REFRIGERATION AIR CONDITIONING COMMERCIAL

"Builders of Condensing Units Since 1922"

Division of Curtis Manufacturing Company

Now! An easy way to end "DRY AIR" Complaints

IF you have complaints during the winter heating season about the drying out of materials . . . shrinkage and warping of boards . . . curling of flat material . . . brittleness of thread or filaments . . . trouble with static-charged machines, then it would be a good idea for you to know about Armstrong Steam Type Humidifiers.

TYPE K-2A

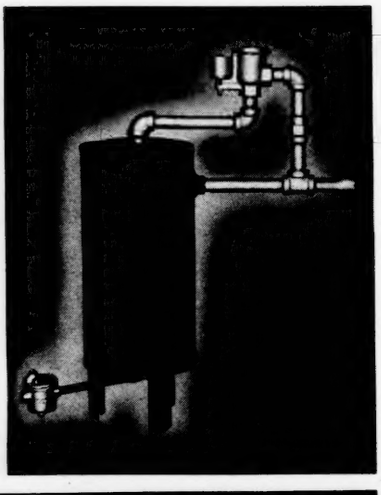
(Left)—This is a unit humidifier for overhead mounting in rooms heated by individual pipe coils or radiators. It is also ideal for mounting in front of individual unit heaters. Long rooms are taken care of by spacing these units at proper intervals.

LIST PRICE: $100.00, complete with Friez Humidistat, solenoid control valve, fan, strainer, and condensate drainage trap. Discounts on application.

TYPE K-4

(Right) — A large capacity unit well-suited for installations with central duct heating systems and with large floor type unit heaters.

LIST PRICE: $325.00, complete with Friez Humidistat, solenoid control valve, strainer, and condensate drainage trap. Discounts on application.



ARMSTRONG
STEAM TYPE
HUMIDIFIERS

ARMSTRONG MACHINE WORKS
846 Maple St., Three Rivers, Mich.

GENTLEMEN: I want to know more about Armstrong Humidifiers for my ..... plant. I have to humidify approximately ..... cu. ft. of space.

☐ Send suggestions, prices, etc.
☐ Have representative call on me.

Name.....
Company.....
Street .....
Town..... State.....

COMING EVENTS

JANUARY 12-13, 1940. Fifth annual meeting of the Louisiana Engineering Society. Headquarters, St. Charles Hotel, New Orleans. Further information available from Arthur J. Naquin, Chairman, Publicity Committee, Louisiana Engineering Society, Suite 422, St. Charles Hotel.

JANUARY 15-18, 1940. Sixth annual convention of the Refrigeration Service Engineers Society in conjunction with the Second All-Industry Refrigeration and Air Conditioning Exhibition sponsored by the Refrigeration Equipment Manufacturers Association, to be held in Chicago. National Secretary of the Society, H. T. McDermott, 433 N. Waller Ave., Chicago.

JANUARY 17-19, 1940. 35th Annual Meeting, American Society of Refrigerating Engineers, Hotel Blackstone, Chicago, Ill. ASRE headquarters, 37 West 39th St., New York.

JANUARY 22-24, 1940. Annual convention, National Warm Air Heating and Air Conditioning Association, Hotel Hollenden, Cleveland, Ohio. To be held in conjunction with the Sixth International Heating and Ventilating Exposition. NWAH & AC Assoc., Managing Director, 5 E. Long St., Columbus.

JANUARY 22-26, 1940. 46th annual meeting of the American Society of Heating and Ventilating Engineers, Hotel Statler, Cleveland, Ohio. To be held in conjunction with the Sixth International Heating and Ventilating Exposition. ASHVE, 51 Madison Ave., New York.

JANUARY 22-26, 1940. Sixth International Heating and Ventilating Exposition to be held at Lakeside Hall, Cleveland. Exposition under the direction of Charles F. Roth, International Exposition Co., Grand Central Palace, New York.

WITH THE MANUFACTURERS

Sterling Pump Corporation, Hamilton, Ohio, has appointed *Henry J. McKenzie* executive vice-president. Mr. McKenzie is a nationally known authority on pumps and pumping equipment, having had many years of experience in connection with deep-well turbine pump installations.

Williams Oil-O-Matic Heating Corp., Bloomington, Ill., has appointed *Samuel F. Baker* as general sales manager. In this capacity Mr. Baker will be directly responsible for the company's oil burner, refrigeration, and air conditioning sales. Mr. Baker was formerly general manager of a stoker company.

PHOTOGRAPHIC CREDIT

Listed below are the names of the companies and persons furnishing photographs for this issue:

PAGES 13 and 14—San Antonio Public Service Co., San Antonio, Texas.

PAGE 18—General Foods Corporation, New York.

PAGE 19—Fairchild Aerial Surveys, Inc., New York, New York.

PAGES 20, 21 and 22—General Foods Corporation, New York, N. Y.

PAGES 23, 24, 25 and 26—American Gas Association, New York, N. Y.

PAGE 29—Carrier Corporation, Syracuse, N. Y.

PAGE 33—Holmes I. Mettee, Baltimore, Md.

NEW TRADE LITERATURE

Air Outlets. A catalog entitled "Anemostats for Use in Railroads." Contains details on the type "CM" Anemostat high velocity air diffuser and the type "CRL" Anemostat-lights, which combine air distribution with modern lighting. Also contains a number of suggestions on air outlet arrangements in modern railway cars. ANEMOSTAT CORP., OF AMERICA, NEW YORK, N. Y.....24

Bearings. A slide rule listing over 800 sizes of standard stock bearings of the Johnson Bronze Co. Slide rules are available to readers making their request on business letterhead. JOHNSON BRONZE CO., NEW CASTLE, PA. 25

Fans. A standard size, 24-page catalog of DeBothezat axial flow fans. Catalog includes a description of more than 200 axial flow pressure fans ranging in size from 8 in. to 10 ft. DEBOTHEZAT VENTILATING EQUIPMENT DIVISION, AMERICAN MACHINE AND METALS, INC., EAST MOLINE, ILL. 26

Leather Belts. A standard size, spirally bound, leather belt-drive data book, giving information on the selection of leather belts for use with short center pivoted-motor bases. Gives information on the outstanding features of this type of drive, efficiency and methods of selection. AMERICAN LEATHER BELTING ASSOCIATION, NEW YORK, N. Y. 27

Refrigeration Units. Two 6-page folders dealing with Worthington-Carbondale refrigeration units for Freon or methyl chloride. Bulletin C-1100-B6 discusses low pressure refrigeration units which have capacities from ¼ to 25 hp. and employ Freon 12 or methyl chloride. Bulletin C-1100-B7 takes up refrigeration units from 75 to 125 hp. employing Freon 12. Both bulletins give information on construction, sizes and capacities. CARBONDALE DIVISION, WORTHINGTON PUMP AND MACHINERY CORPORATION, HARRISON, N. J. 28

Water Treatment. An eight-page pocket-size bulletin. Chemicals described include Artgel which is designed to remove scale accumulation from the water side of boilers, condensers, diesel and gas engines; Artic feedwater treatments for maintaining control of boiler feedwater; Artsolv for removing carbon deposits in fuel oil preheaters, lubricating oil coolers and other types of heat exchange units; Artsoot for preventing soot and carbon scale accumulations; and Artic drain pipe cleaner. CHEMICAL AND COMBUSTION CORP., NEW YORK, N. Y. 29

TO OBTAIN COPIES OF TRADE LITERATURE listed in this issue, circle on the list below the publications wanted, using the item number at the end of each review; fill in your name and address, mail to

HEATING & VENTILATING
148 Lafayette St., New York, N. Y.

24 25 26 27 28 29

(This service available only to engineers or executives)

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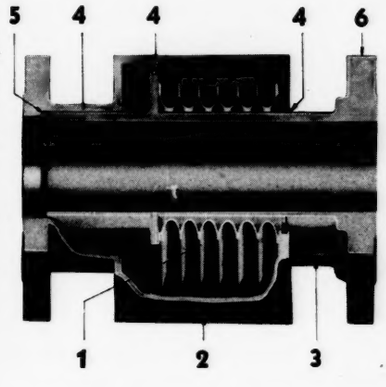
ADSCO PACKLESS, U-RING EXPANSION JOINT
COMPACT AND SIMPLIFIED DESIGN WITH FLEXIBLE STEEL ELEMENT
FOR HIGH PRESSURE, HIGH TEMPERATURE SERVICE



(1) *Expansion Element of corrosion resistant steel* (2) *Steel Body* (3) *Movable Sleeve* (4) *Three-point guiding for Sleeve* (5) *Limit Stop* (6) *Flanged or beveled ends for welding.*

Corrosion Resistant Steel Expansion Element

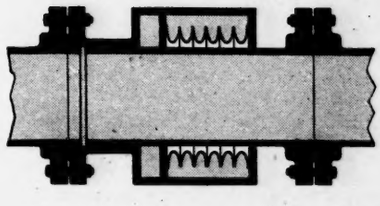
Under least strain when in service

The only packless expansion joint where the expansion element is under compression when in operation and under minimum flexing strain when in service.

The expansion element is a series of corrosion resistant steel U-Rings welded to the steel body and to the guide on the sleeve, forming a permanent seal between the stationary body and the movable sleeve. The steel body is similar in quality and thickness to the pipe itself. A full, unrestricted opening is provided through the joint by the movable sleeve.

Especially suitable for installation in underground or surface pipe lines in inaccessible locations—requires no maintenance. Available with flanged or beveled ends, with or without anchor base for pressures to 300 lbs.

Write for new Bulletin No. 35-50-A.

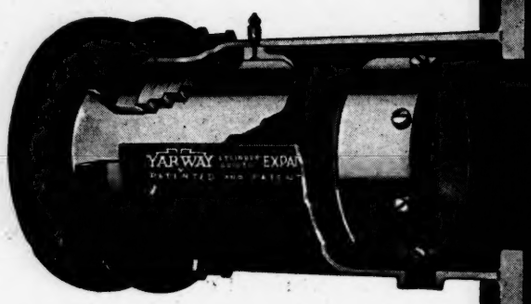


How it Operates

Diagrammatic sketch above illustrates the principle of operation. The dotted area represents the steam space through the joint and around the outside of the element. The inside of the element is under atmospheric pressure and the line pressure is on the outside of the element. No dirt or scale can enter the element to interfere with its operation.

AMERICAN DISTRICT STEAM COMPANY
NORTH TONAWANDA, N.Y.
IN BUSINESS OVER SIXTY YEARS

CYLINDER-GUIDED FOR TROUBLE-FREE SERVICE



Made in single or double end types with or without base.

YARWAY

EXPANSION JOINTS

Welded Steel construction. Alemite lubrication. Diameter no larger than pipe flange... Outside cylinder guide design prevents abrasive sediment from cutting the sleeve. Write for catalog EJ-1904, which describes both Gland-Pakt and revolutionary Gun-Pakt (packed under pressure) types.

YARNALL WARING COMPANY, Philadelphia
104 MERMAID AVENUE

***RUBBER INSULATED**

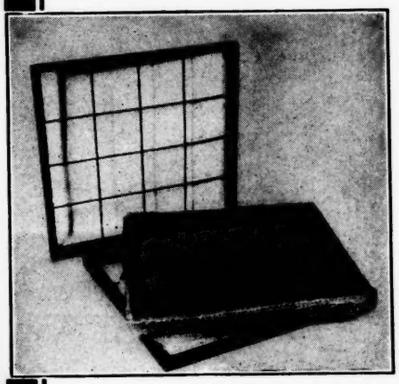
This sound-insulated ball bearing pillow block, developed by Ahlberg, provides silent anti-friction efficiency. It is the ideal light duty bearing for air-conditioning equipment, fans, furnace blowers, etc.

Its precision, quiet-running (CJB) bearing is completely cushioned from the all-metal housing with Neoprene, newest synthetic rubber, which is impervious to oil. Frictionless, labyrinth-type seals, also of Neoprene, provide real protection for the bearing.

Silence is the word on this new pillow block. Cost is very reasonable. Write for the Bulletin (shown at left) for complete details and prices.

AHLBERG BEARING COMPANY
Manufacturers of (CJB) Master Ball Bearings
3011 WEST 47TH ST., CHICAGO, ILLINOIS
*(Neoprene)

WALTON



Refillable Air Filters

TYPE W-R

Easy Installation

The steel frame of the NEW Walton Air Filter is easy to install, and, once installed, it becomes a permanent part of the system. It makes a neater set-up, never has to be replaced and eliminates the necessity for fibre frames on filter pads. Pads are more easily replaced, thereby assuring you a greater volume of repeat refill business.

Write for details of the many other new features of the Type W-R Walton Re-fil-able Air Filters.

RESEARCH PRODUCTS CORP.
MADISON WISCONSIN

E-Z

Radiator Hangers The efficient, durable, economical way to hang radiators. A type for every radiator and every situation.

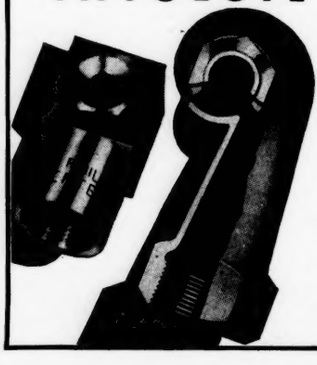
Concrete Inserts Only one size is needed for all size pipe hangers. Easily adjustable, with play for expansion.

Lavatory Hangers The strong, permanent, economical way to suspend lavatories from the wall.

HEALY-RUFF CO., 772 Hampden Ave.
St. Paul Minnesota

YARWAY

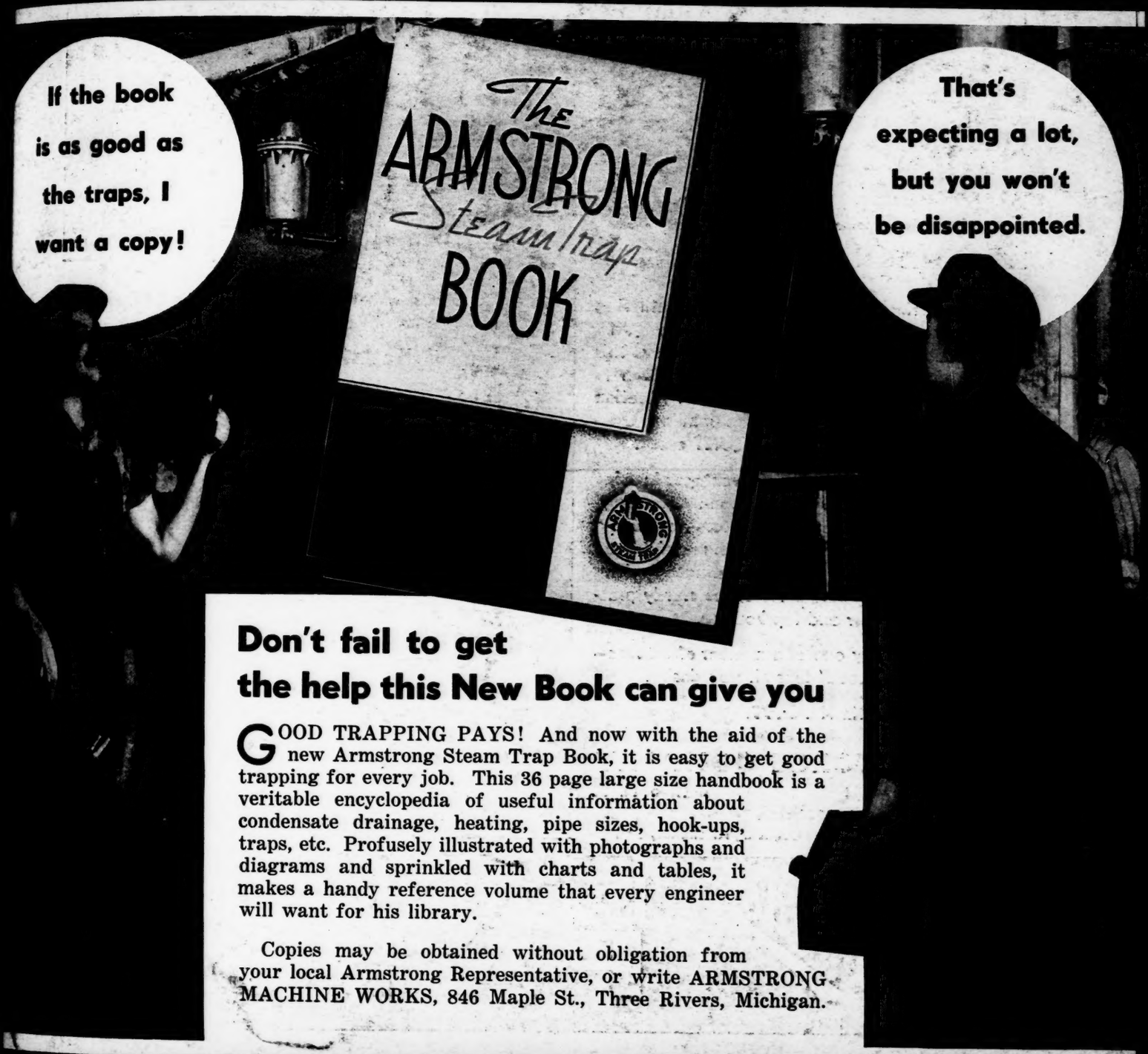
INVOLUTE NOZZLES



The preference for trouble-free air washing service — because there are no internal parts or vanes to wear or clog. Proven through many years of service in water cooling and air conditioning installations totaling more than 5 million g. p. m.

Made in sizes and types for all requirements. Ask for Bulletin N-615.

YARNALL-WARING CO., PHILA.
104 MERMAID AVENUE

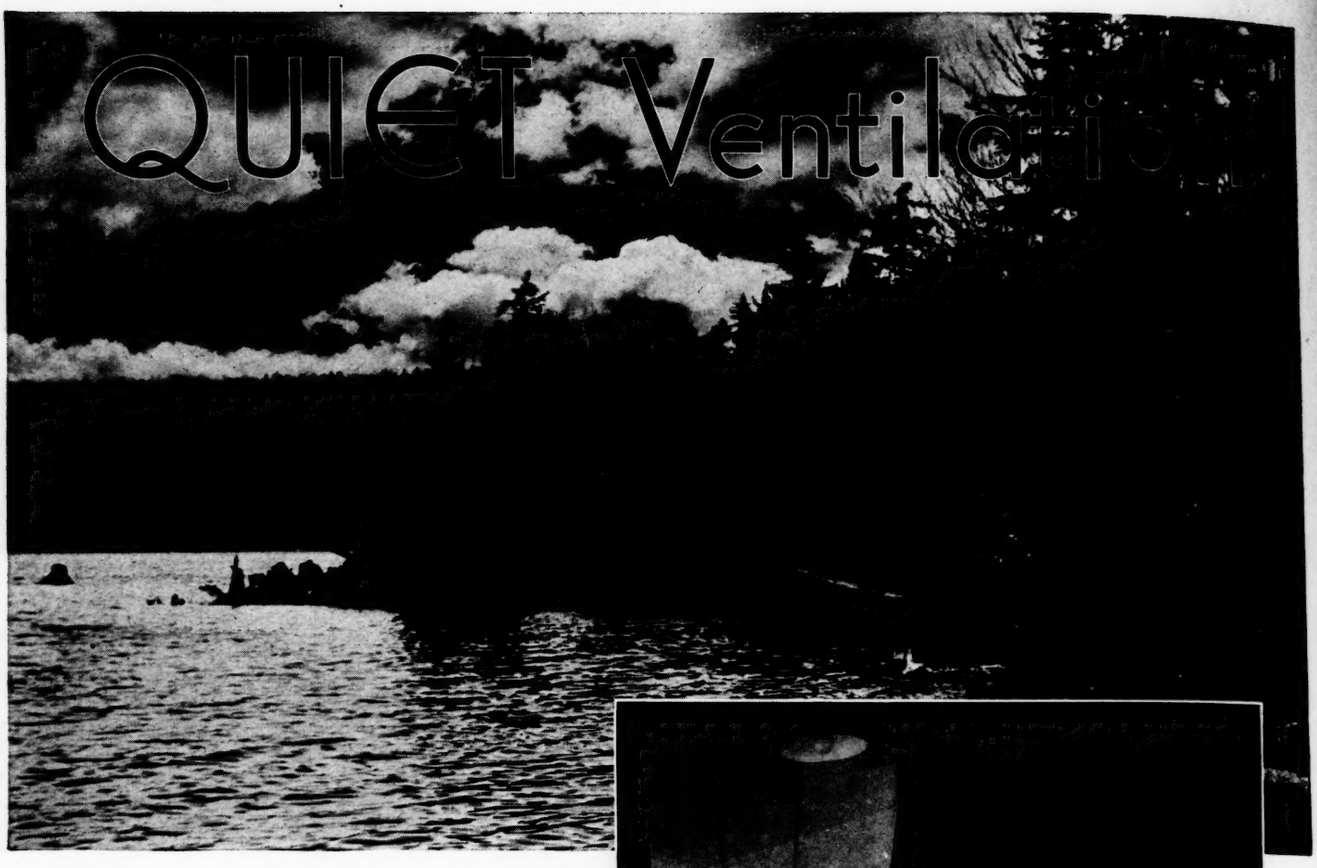

If the book is as good as the traps, I want a copy!
The ARMSTRONG Steam Trap BOOK
That's expecting a lot, but you won't be disappointed.

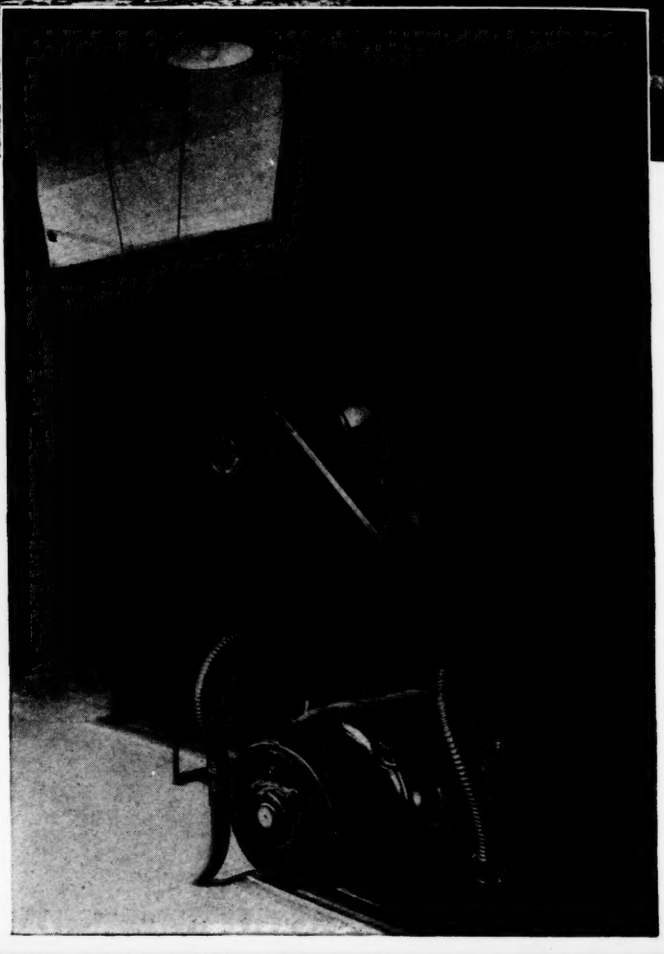
Don't fail to get the help this New Book can give you

GOOD TRAPPING PAYS! And now with the aid of the new Armstrong Steam Trap Book, it is easy to get good trapping for every job. This 36 page large size handbook is a veritable encyclopedia of useful information about condensate drainage, heating, pipe sizes, hook-ups, traps, etc. Profusely illustrated with photographs and diagrams and sprinkled with charts and tables, it makes a handy reference volume that every engineer will want for his library.

Copies may be obtained without obligation from your local Armstrong Representative, or write ARMSTRONG MACHINE WORKS, 846 Maple St., Three Rivers, Michigan.

Modernize Now! Armstrong Now!





The selection of Buffalo "Limit-Load" Ventilating Fans automatically assures the user of really QUIET Ventilation. Accurate decibel readings prove this —and when these fans are mounted on Buffalo Silent Floating Bases which dampen out vibration noises ordinarily transmitted to the building framework — then you have a really QUIET outfit.

Of course, there are other advantages in using "Limit-Load" fans, such as the "non-overloading" characteristic which prevents motors from being overloaded regardless of operating conditions; the improved Buffalo Sleeve Bearings specially designed for ventilating service, the sturdy practical design of rotor and fan housing.

In short—for any one of a number of reasons—you'll find "Limit-Load" fans all you desire.

Write for Bulletin No. 3099.

BUFFALO FORGE COMPANY

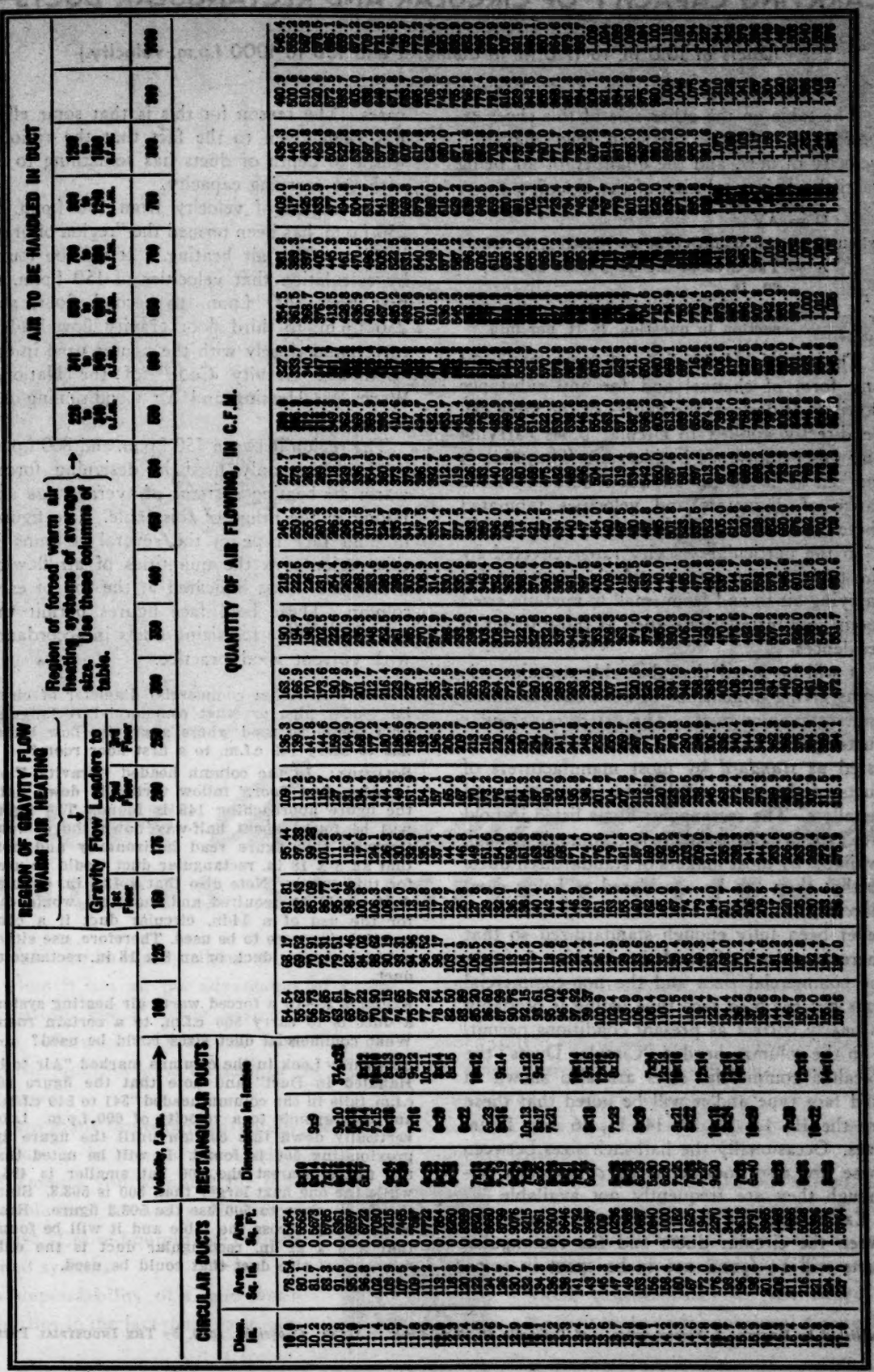
480 Broadway Buffalo, N. Y.

Branch Engineering Offices in Principal Cities
Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

"Buffalo" Limit-Load FANS

CARRYING CAPACITY OF CIRCULAR AND RECTANGULAR DUCTS—4

(Ducts of 10.0 in. to 17.0 in. in diameter and 100 to 1000 f.p.m. velocity.)


QUANTITY OF AIR FLOWING, IN C.F.M.
AIR TO BE HANDLED IN DUST
REGION OF GRAVITY FLOW WARM AIR HEATING
Gravity Flow Leaders to
1st Floor
2nd Floor
3rd Floor
Region of forced warm air heating systems of average size. Use these columns of table.
CIRCULAR DUCTS
Diam. In.
Area Sq. In.
Area Sq. Ft.
RECTANGULAR DUCTS
Dimensions in inches
Velocity, f.p.m.

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H. & V.'s REFERENCE DATA—163

CARRYING CAPACITY OF CIRCULAR AND RECTANGULAR DUCTS—4

(Ducts of 10.0 in. to 17.0 in. in diameter and 100 to 1000 f.p.m. velocity.)

The table on the other side of this sheet expresses the relation between duct diameter, velocity of flow, and the quantity of air being carried. It is a solution of the equation

$$Q = AV$$

when Q = the quantity of air flowing, in c.f.m.,
A = The area of the duct cross section, sq. ft.
V = the mean velocity of flow at the cross section in question, in ft. per min.

The equation holds for any cross section of any form of channel and for any substance flowing. If desired, the figures of the table can be directly applied to circular pipes carrying any other substance besides air. The table is marked as being for air ducts because in the range of diameters and velocities tabulated these ducts are commonly used for carrying air.

In the particular velocity range covered by the table, important uses of air ducts are for carrying air to and from small to medium sized rooms and installations, such as those found in residences.

It will be noted that the table contains columns giving dimensions of both circular ducts and rectangular ducts. The list of rectangular ducts given includes all those commercially listed as *standard* by most manufacturers of ducts of the type supplied to contractors and installers. The rectangular ducts listed in bold face type are those which are commonly enough available by most makers of standardized ducts so that they can be considered as being *commercial sizes*. Duct sizes and dimensions have never been fully enough standardized so that there is no strict line of demarcation between the commercial sizes and the non-commercial sizes but the bold face type listing is probably as nearly correct as present conditions permit.

In the columns headed "Circular Ducts" the so-called commercial sizes are also shown in bold face type and it will be noted that these are the 10, 11, 12, 13, 14, 15, 16 and 17 in. sizes. Occasionally the half-inch sizes between these are also considered as *commercial*, although they are frequently not available.

Examination of the equivalence of area between the circular ducts and the rectangular ducts will be found not to be exact in some cases. The reason for this is that some effect has been given to the fact that the ratio of width to depth of ducts has something to do with the carrying capacity.

The region of velocity from 150 f.p.m. to 250 f.p.m. has been termed the "region of gravity flow warm air heating." It will be found by calculation that velocities of 150 f.p.m. to first floor, 200 f.p.m. to second floor, and 250 f.p.m. to third floor gravity flow leaders correspond closely with the figures used in the "Standard Gravity Code" of the National Warm Air Heating and Air Conditioning Association.

The region between 550 f.p.m. and 800 f.p.m. is that commonly used in designing forced warm air heating systems of average size and falling in the range of this table. The figures in bold face type in the several columns in this region give the quantities of air flowing within the limits indicated at the top of each column. These bold face figures permit the use of the table for sizing ducts in accordance with current good practice.

Example 1.—What commercial diameter of circular leader pipe or what commercial rectangular duct would be used where a gravity flow leader has to carry 149 c.f.m. to a first floor room?

SOLUTION: In the column headed "Gravity Flow Leaders, first floor," follow vertically down until the figure approaching 149 is found. The figure will be found about half-way down the column. Opposite this figure read horizontally and note that an 8 x 18 in. rectangular duct would be used for this supply. Note also that a 13.5 in. circular duct would be required and that this would call for the use of a 14-in. circular duct if a commercial size were to be used. Therefore, use either a 14-in. circular duct, or an 8 x 18 in. rectangular duct.

Example 2.—In a forced warm air heating system a duct is to carry 500 c.f.m. to a certain room. What commercial duct sizes could be used?

SOLUTION: Look in the columns marked "Air to be Handled in Duct" and note that the figure 500 c.f.m. falls in the column headed "341 to 549 c.f.m." and corresponds to a velocity of 600 f.p.m. Look vertically down this column until the figure approximating 500 is found. It will be noted that the figure nearest the 500 but smaller is 495.0 while the one next larger than 500 is 503.3. Since this is so close to 500 use the 503.3 figure. Read horizontally across the table and it will be found that a 6 x 22 in. rectangular duct is the only *commercial* size duct that could be used.

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YOU'LL find it easy to satisfy clients with a heating system when it has all the advantages of Crane Automatic Heating. For a Crane System will bring them carefree, effortless comfort all winter long—regardless of the fuel they wish to burn or the type of heating they prefer.

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When you specify Crane Automatic Heating, you gain for yourself and your client the added protection of one high standard of quality, one source of supply, and one undivided responsibility for the entire system. Talk it over with your local Crane Branch.

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GET BETTER HEATING WITH LESS STEAM IN ROCHESTER HOSPITAL

Genesee Hospital Group Secures Even Heat Distribution with Webster Hylo System

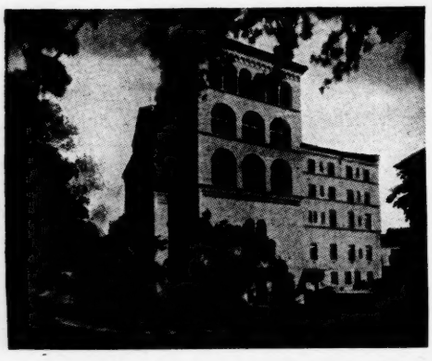
5 YEARS OF HEATING ECONOMY

Saves Over 3 Million Pounds of Steam Annually During Three Recent Heating Seasons

Rochester, N. Y.—Improved heating secured in the group of buildings which make up The Genesee Hospital is a result of a Webster Heating Modernization Program carried out in 1934.

Before modernization, it was estimated that the Webster Hylo System would save 1,182,000 lbs. of steam annually, while providing even heat distribution.

During three recent heating seasons, 1936 to 1939, the Webster Hylo System has helped The Genesee Hospital to save 3,072,074 lbs. of steam annually with a marked improvement in heating service.



The Genesee Hospital, Rochester, N. Y., North Wing

The Webster Hylo System takes steam from any source at any pressure and assures efficient, economical distribution. In The Genesee Hospital Group, steam is secured from the mains of the Rochester Gas & Electric Co. Landis Shaw Smith, of this Company, says:

"With Webster heating controls, steam consumption has been substantially reduced in The Genesee Hospital. On that point, the record speaks for itself. What is more important, the comfort that is so essential in hospital service has been maintained."

Dr. Leslie H. Wright, Superintendent of The Genesee Hospital, is well satisfied with the savings and heating comfort secured with the Webster Hylo System.

Martin W. Utz Co., of Rochester, acted as modernization heating contractor.

LESS STEAM NEEDED TO HEAT HOSPITAL AT SARANAC LAKE

Webster Moderator System Helps Well-Known Institution to Get Better Heating

COMFORT IN COLDEST WEATHER

Well-Balanced Heating Important Factor in Hospital Operation, Board Member Declares

EVEN HEATING IN ALL WINGS

Saranac Lake, N. Y.—Heating comfort at low cost has been provided in the Saranac Lake General Hospital since 1936 by a Webster Moderator System of Steam Heating.

Difficulty formerly experienced in providing even steam distribution in the various wings of the building has been corrected and the amount of steam necessary to maintain comfortable temperatures has been reduced.

An official at the Hospital says:

"Comfortable heating is an important factor in hospital operation. In our building, where there is an unusual amount of exposed wall area, the performance of the Webster Moderator System has resulted in very even distribution of steam and minimum steam consumption. Regardless of the severity of the weather, the Hospital is always comfortably warm."

Saranac Lake General Hospital, Saranac Lake, N. Y.

An Outdoor Thermostat automatically adjusts the basic rate of steam delivery with every change in weather or wind direction. A manual Variator allows the operator to vary the steam supply to meet special conditions.

Installation of Webster System Equipment, along with a complete new high-pressure boiler plant, was made by the Carson Bros., Saranac Lake heating contractors. There is a total of 5,000 sq. ft. of installed direct radiation.

FAMOUS ORTHOPEDIC HOSPITAL IMPROVES HEATING SERVICE

Webster Moderator System Gives Eastern New York Orthopedic Hospital Increased Comfort

REDUCES STEAM CONSUMPTION

Achievement of Two Conflicting Objectives Pointed Out by the Architect

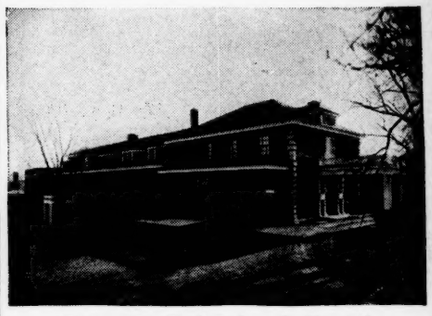
"CONTROL-BY-THE-WEATHER"

Schenectady, N. Y.—The Eastern New York Orthopedic Hospital, one of the outstanding institutions in the country for the care of crippled children, reduced heating costs and improved heat distribution with a Webster Moderator System installed in 1936 when a new large addition was built.

Before heating modernization, it sometimes proved difficult to heat the Hospital adequately during severe weather.

With the Webster Moderator System, overheating and underheating have been reduced to a minimum. Heat is distributed evenly and rapidly to all sections of the Hospital through accurately sized Webster Metering Orifices.

An Outdoor Thermostat automatically adjusts the basic rate of steam delivery with every change in weather or wind direction. A manual Variator allows the operator to vary the steam supply to meet special conditions, such as heating up.



Eastern New York Orthopedic Hospital, Schenectady, N. Y.

J. M. Ryder, Schenectady, Architect for the project, reports:

"There has been a definite improvement in heating service since 1936. By reducing steam consumption, the Webster Moderator System has achieved two seemingly conflicting objectives."

The E. J. Harbison Co., of Schenectady, acted as modernization heating contractors. There is a total of 7,200 sq. ft. of installed direct radiation. The Hospital addition was constructed in 1936.

PROFIT FOR YOU

In nearly every city, heating contractors are developing worthwhile business in modernizing hospital heating installations by changing to Webster Central Control Systems. Write for "General Catalog."

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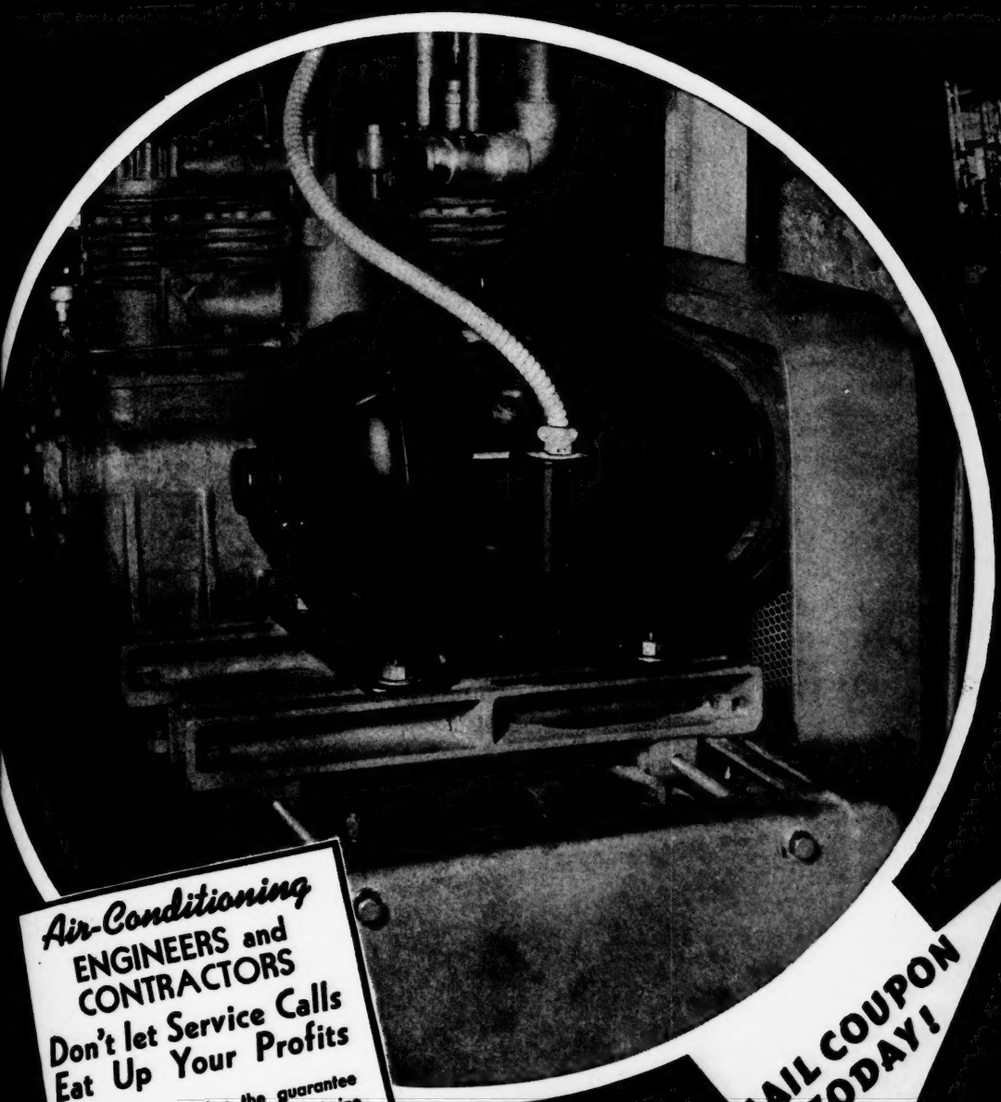
The selection of the right motor for air-conditioning equipment is essential to the continued success of that equipment. Compressors, pumps, blowers, etc., cannot give fully satisfactory service unless they are correctly motored.

Wagner motors are engineered, designed and built to meet the exacting requirements of all types of refrigeration and air-conditioning equipment. Three of the qualifications that make Wagner motors particularly suited to air-conditioning applications are:

1. GOOD PERFORMANCE. The performance characteristics of Wagner air-conditioning and refrigeration motors meet the exacting requirements of your equipment. Available in a wide range of designs to handle all load requirements.
2. QUIET OPERATION. Dynamically-balanced rotors, accurately-machined end-plates, diamond-bored bearings — these and other important engineering features assure quiet, smooth operation of the motor and your equipment.
3. LOW MAINTENANCE. Because of careful engineering, skillful workmanship and high-grade materials, Wagner motors require very little maintenance other than periodic inspection and oiling.

In addition, Wagner motors embody many other features that are important to the successful operation of air-conditioning equipment. It is to your advantage to investigate how Wagner motors can improve the performance of your equipment. Send coupon for complete information and your copies of bulletins 177 and 182.



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Bethlehem Galvanized Sheets have a soft, ductile base—the kind that makes good workmanship a cinch. There are no hard spots that cause uneven seaming. The sheets are flat, accurately sheared and uniformly coated.

The brightly spangled galvanized coating adds to the fine appearance of completed duct work installations. The zinc coating itself is so tight and ductile that you can bend and seam Bethlehem Galvanized Sheets without a worry about flaking or fluting.

When you want to provide a double defense against rust specify Beth-Cu-Loy, Bethlehem's long-life copper-bearing steel, as the base material.

Bethlehem Galvanized Sheets are available from your distributor.

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SEE THE BETHLEHEM EXHIBIT of steel sheets and pipe at the Sixth International Heating and Ventilating Exposition, Lakeside Hall, Cleveland, Ohio—January 22-26, 1940.

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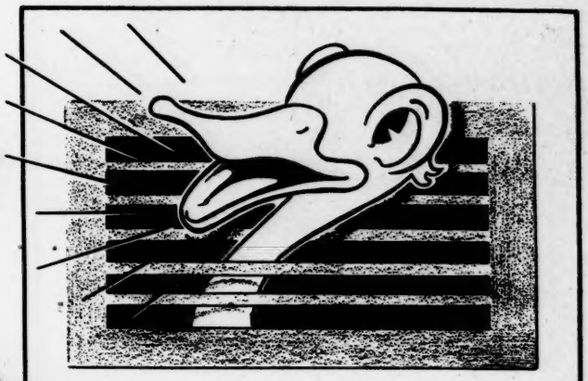

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FIRE RESISTANCE. Silicair will not burn . . . cuts fire hazard to zero.

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Qualified Distributors for this air-conditioning duct lining are invited to write for details of our Protected Territory Franchise and Technical Bulletin.

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[Individual Radiator Control]

Natural conditions, such as climatic variations, wind direction and velocity, combined with radiators that are sized for the COLDEST weather, often cause OVERHEATING problems and extravagant fuel waste on even the finest heating systems.

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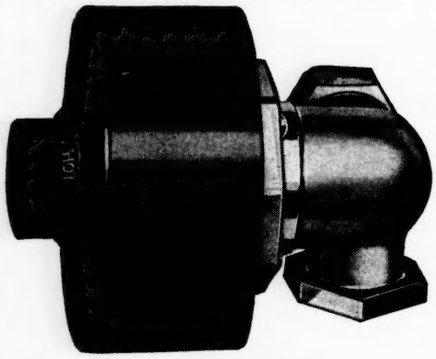

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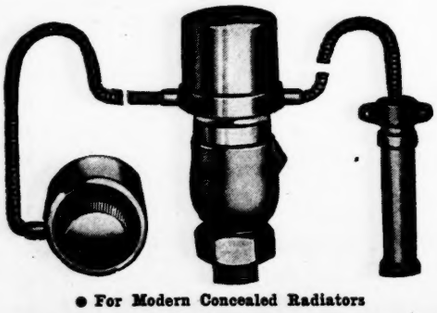

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Install THERMOTROLS in one or two Rooms now giving you "Overheating Trouble." If THERMOTROLS do not keep individual room temperature down to a uniformly comfortable and economical level, you may return them within 60 days—at no cost to you.

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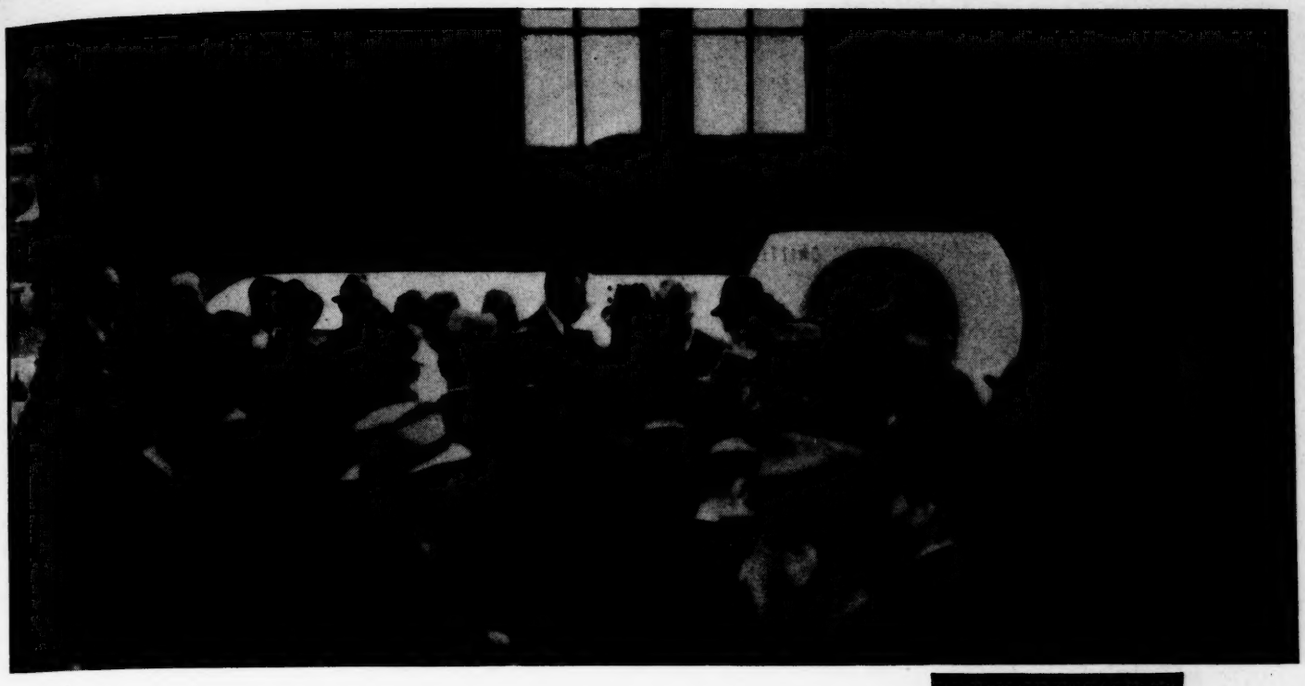

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SIXTH
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CLEVELAND · OHIO
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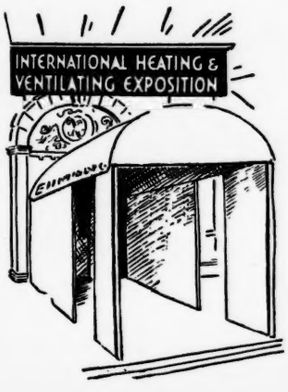
THOUSANDS know from experience that their interests are promoted by attending this great exposition. You can profit in the same manner whether your work includes selling, buying, planning, designing, installing, operating or servicing any part of a heating, ventilating or air conditioning system.



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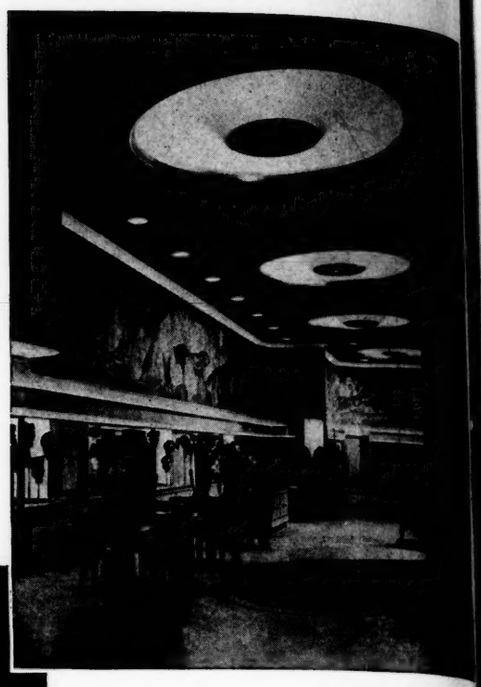
Draftless Air Distribution and Lighting



It is the function of the ANEMOSTAT to draftlessly and evenly distribute any volume of air at any velocity and this in turn results in the prompt equalization of temperature throughout the enclosures. The ANEMOSTAT high velocity air diffuser may also be effectively combined with indirect cove lighting or pendent lighting fixtures.

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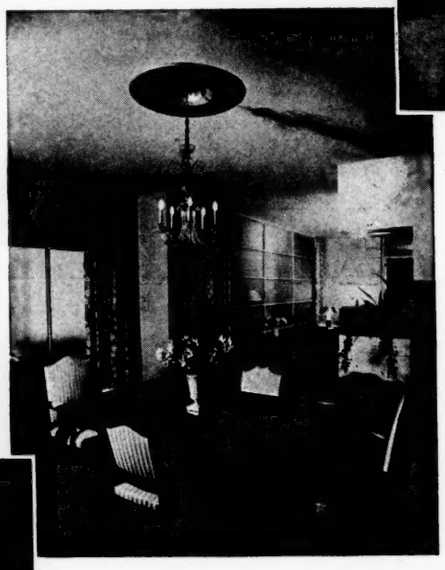
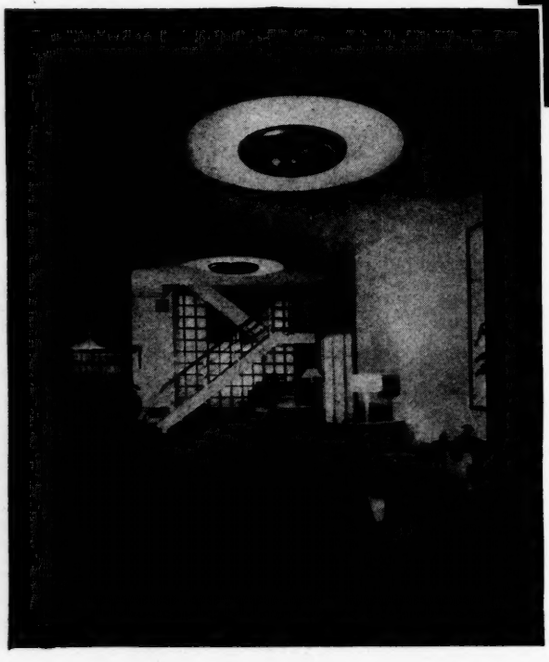
One of the most effective means of illumination is indirect cove lighting. It is particularly suitable wherever unusual and colorful lighting effects are desired. A special combination of ANEMOSTAT and Indirect Cove Lighting is available to solve the problem of draftless air distribution and scientific and artistic lighting.





ANEMOSTAT

PROVIDES
DRAFTLESS AIR DISTRIBUTION
MIXING ROOM AIR
WITH CONDITIONED AIR
WITHIN THE DEVICE
PERMITTING
HIGHER VELOCITIES
GREATER
TEMPERATURE DIFFERENTIALS
RESULTING IN
SMALLER DUCTS
SMALLER PLANT
REDUCED OPERATING EXPENSE

ANEMOSTAT WITH PENDENT LIGHTING FIXTURES

Where indirect cove lighting is impractical pendent lighting fixtures may easily be combined with any type of ANEMOSTAT. With the Type "A" ANEMOSTAT a substantial portion of the heat created by the light is extracted from the room or returned to the conditioner for recirculation.

The uses and applications of the ANEMOSTAT in conjunction with lighting units are practically limitless within the field which the ANEMOSTAT serves. The ANEMOSTAT may be applied to existing systems as well as new installations regardless of size. The ANEMOSTAT has no moving parts and is easily installed.

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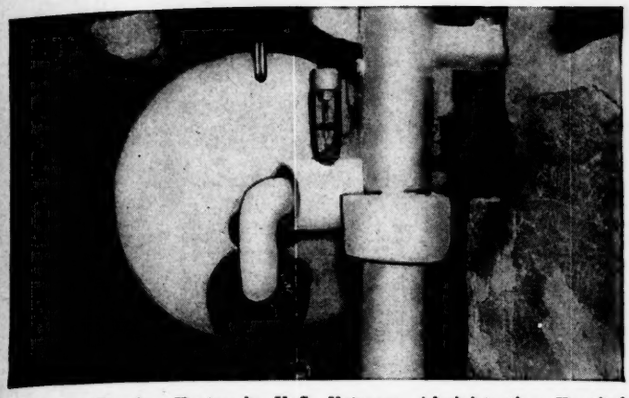

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No Rusty Hot Water Here

Patterson Everdur Hot Water Heaters assure all the rust-free hot water required, as hot as required and as quickly as required.

Made of 96% copper, these heaters cannot rust, therefore last indefinitely and require no expenditure for repairs due to corrosion.

Follow the example of other leading architects and engineers and play safe by specifying the "Patterson."

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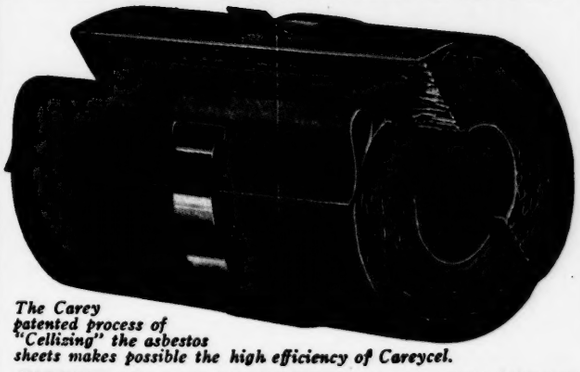
Careycel
ASBESTOS INSULATION

PIPE COVERINGS and BLOCKS



The Carey patented process of "Cellizing" the asbestos sheets makes possible the high efficiency of Careycel.

CAREYCEL—the patented, INDENTED (not corrugated) Asbestos Insulation—is designed specially to insulate pipes, domestic and industrial boilers, water heaters, ovens and other apparatus carrying temperatures up to 300°F.

CUTS HEAT LOSSES 30%

Heat loss through Careycel, according to impartial Mellon Institute tests, is 30% less than through an equal thickness of aircell (coarse corrugated) asbestos insulation. Shrinkage is negligible—only 0.05%. Provides smoother outer surface. Careycel may be obtained in the form of pipe covering; sheets and blocks, either flat or curved to any desired radius.
For complete data on this ultra-modern insulation, write Dept. 49.

THE PHILIP CAREY COMPANY • Lockland, Cincinnati, Ohio
Dependable Products Since 1873
BRANCHES IN PRINCIPAL CITIES

DEFINITE LEADERSHIP

over

650 Miles

of RIC-WIL CONDUIT NOW IN USE—

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▲ INTERLOCKING-ASSEMBLY
▲ FAST - EASY INSTALLATION
▲ SUPER STRENGTH & DURABILITY
▲ 90%+ EFFICIENCY
▲ ENGINEERED TO OUTLAST ANY SYSTEM
▲

Ric-wiL Standard Tile Systems are built for ordinary conditions found in steam heating or power lines. Ric-wiL SuperTile Conduit is an extra weight heavy duty system designed for underground lines run beneath traffic and for systems laid in trenches of unusual depth. Ric-wiL Cast Iron Systems meet railway specifications for use under rail traffic. Ric-wiL Insulated Pipe Units are a pre-fabricated system using Armco Iron Conduit and including insulation, pipes, and all accessories, delivered complete ready to install. Descriptive bulletins on any or all types sent promptly on request.

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ALPHABETICAL INDEX OF ADVERTISERS

Ahlberg Bearing Co. 64
Air Conditioning Exposition 9
Alter, Harry, Co. 66
American District Steam Co. 63
Anemostat Corporation of America 10
Armstrong Machine Works Front Cover-62

Badger, E. B., & Sons Co. 59
Barber-Colman Co. . . Inside Back Cover
Bethlehem Steel Co. 6
Buffalo Forge Co. . . Inside Front Cover

Carey, Philip, Co. 65
Classified Advertisements 66
Crane Co. 3
Curtis Refrigerating Machine Co.. 61

Detroit Lubricator Co. 61
Dunham, C. A., Co. 57

Healy-Ruff Co. 64
Heating & Ventilating Exposition, 6th International 9

Lovejoy Flexible Coupling Co. ... 63

Nash Engineering Co. 12

Patterson-Kelley Co., Inc. 65
Powers Regulator Co. ....Back Cover

Research Products Corp. 64
Ric-wiL Co. 65

Sterling Engineering Co. 8

Wagner Electric Corp. 5
Want Advertisements 66
Webster, Warren, & Co. 4
Western Silicair Products, Inc.... 7
Wing, L. J., Mfg. Co. 66

Yarnall-Waring Co. 64

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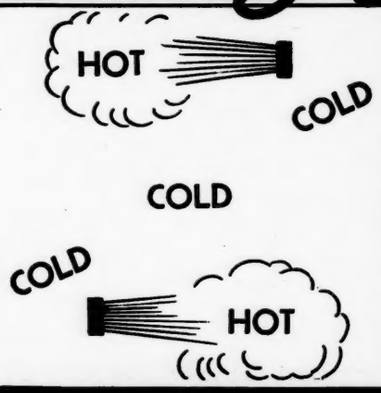
Heating Buildings



If the presence of hot spots and cold spots in your buildings is immaterial to you — you'll not be interested in this information

But if you wish to avoid them and improve the efficiency of your workmen and equipment and to preserve perishable goods here's information of vital interest to you

A new sensation of fresh, live, invigorating heat is created by this heater with the discharge outlet that slowly revolves.

No hot spots, no cold spots, no drafts can exist because the moving air stream produces an active state of air turbulence which results in a constant gentle air motion throughout the working area.

Even in plants where equipment or other objects would obstruct the flow of heat from a fixed discharge, the constantly changing direction of flow accomplishes complete coverage to the walls and corners of the plant.

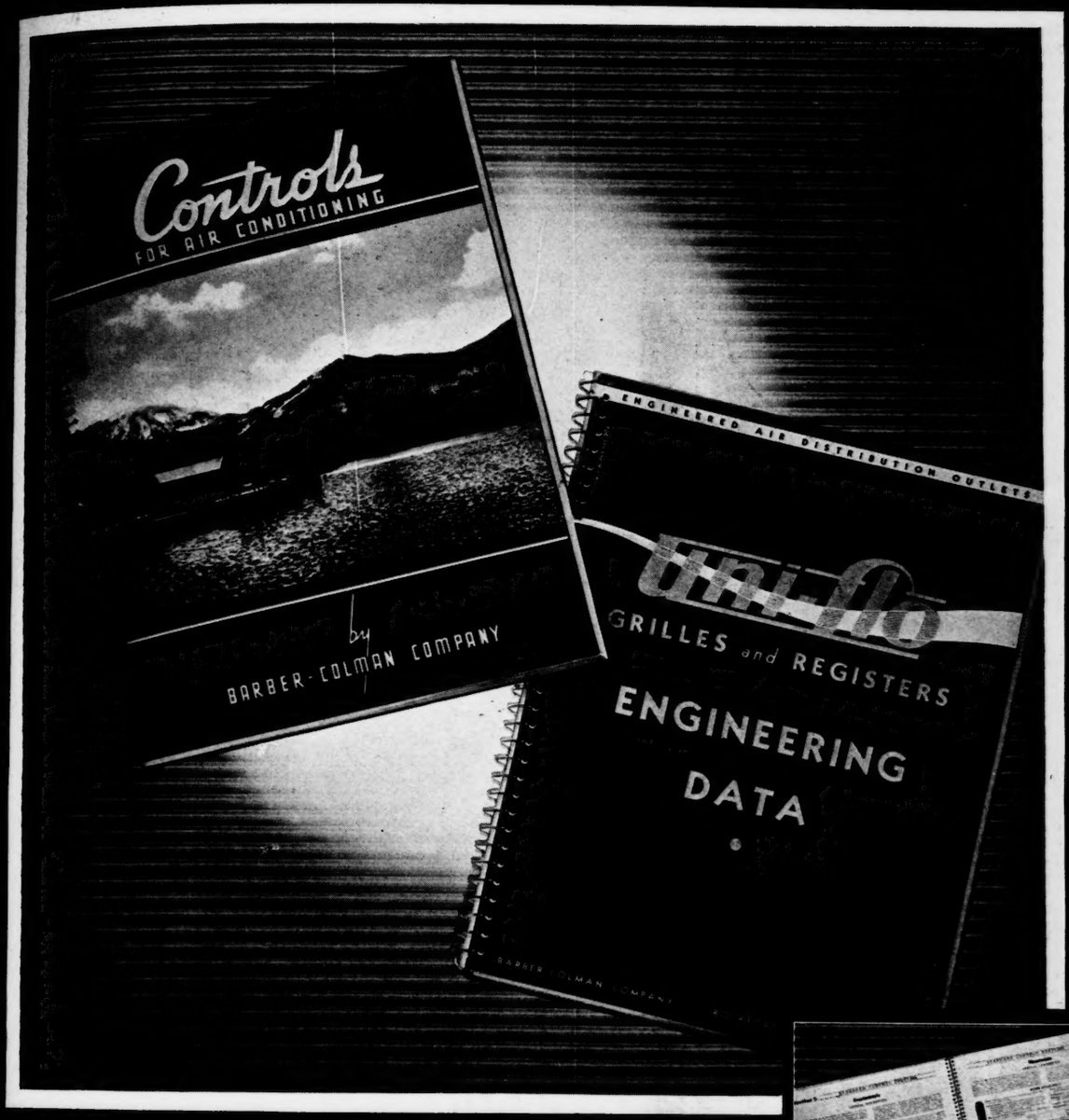
Send for Bulletin H-7

L. J. Wing Mfg. Co.

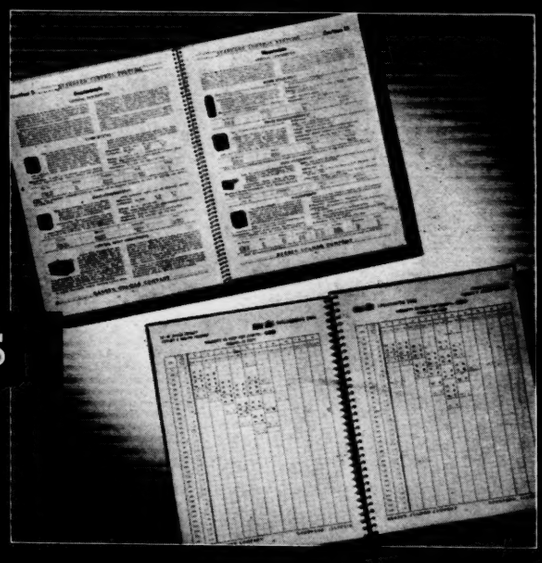
158 W. 14th Street New York, N. Y.

Wing *Revolving Discharge* *Featherweight* **UNIT HEATERS** *Floodlights of Heat*

BARBER-COLMAN



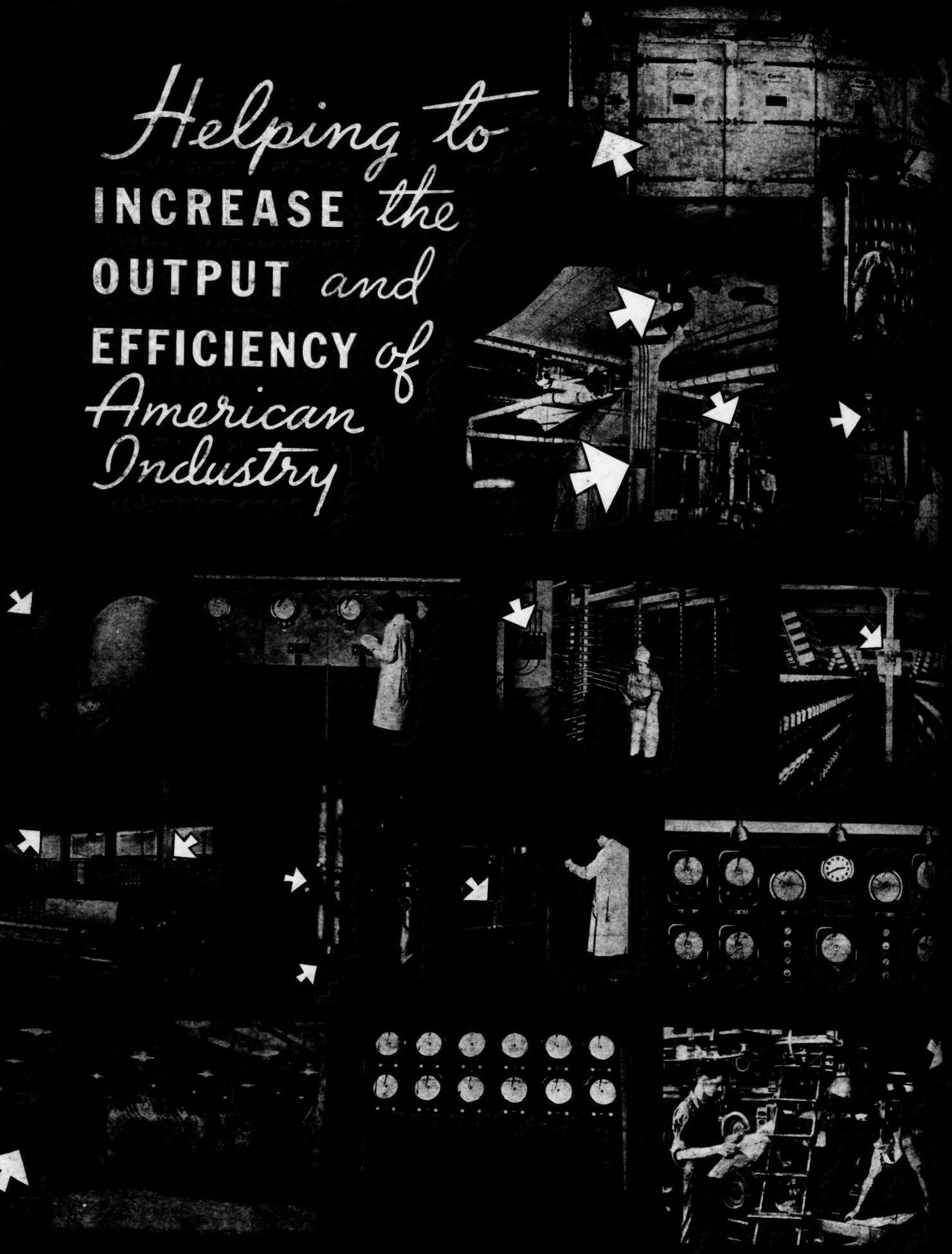
CONTROLS



CONTROL SYSTEMS

BARBER-COLMAN COMPANY

Helping to
INCREASE *the*
OUTPUT *and*
EFFICIENCY *of*
American Industry



POWER